Chemical Age 14 January 1950 ANNUAL REVIEW NUMBER

The Chemical Age

VOL LXII 14 JANUARY 1950 No 1592

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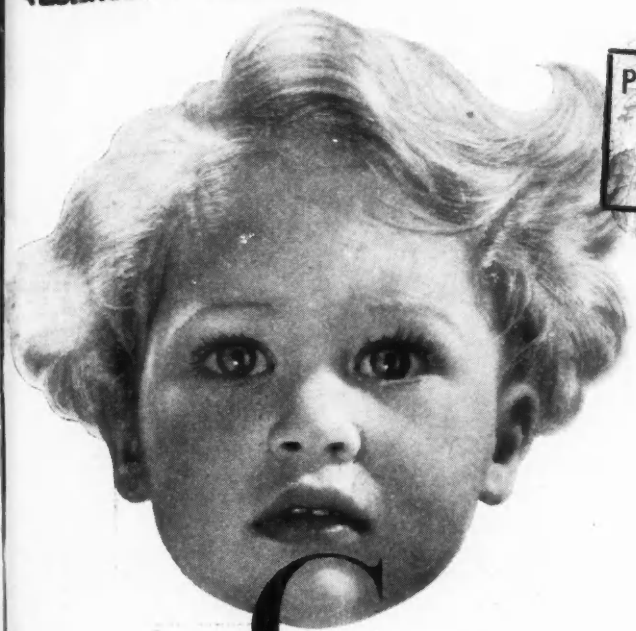

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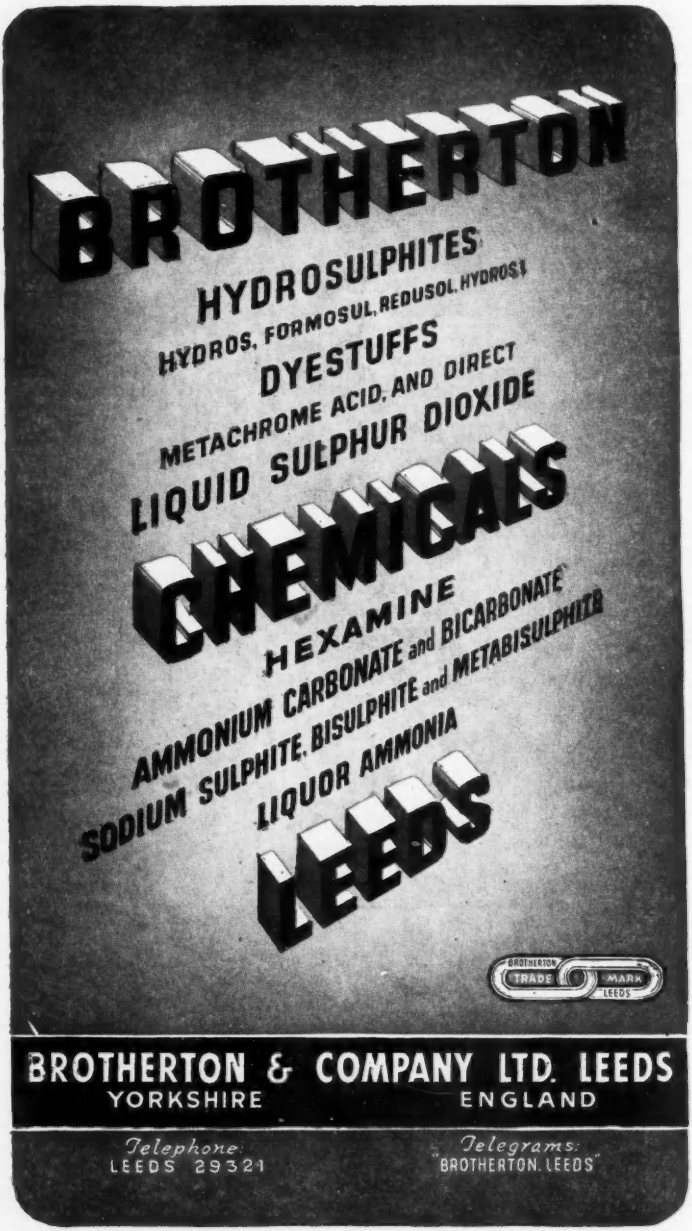
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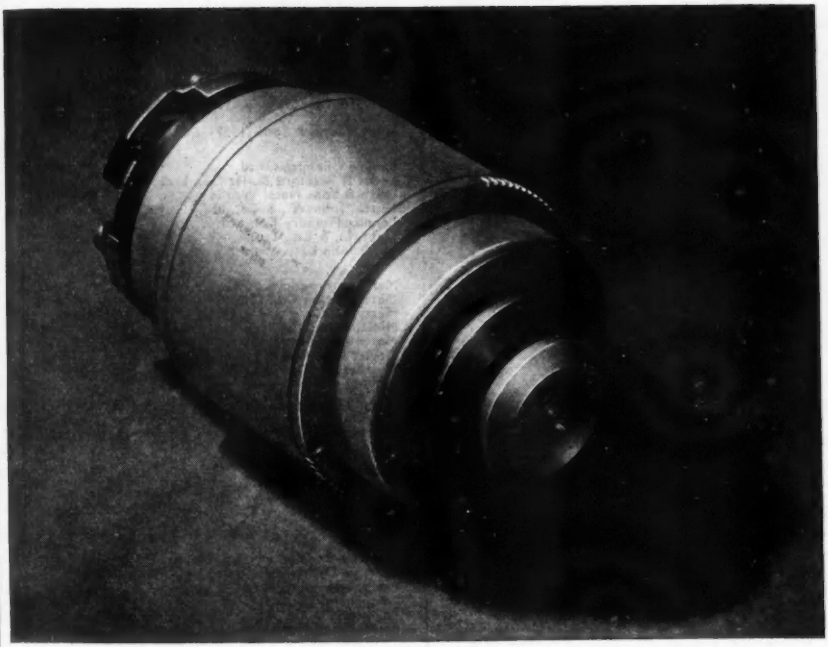

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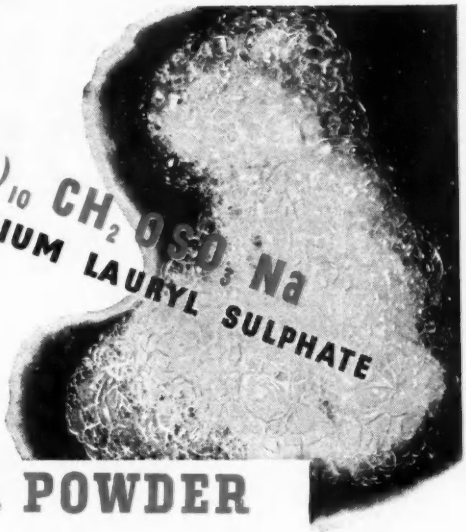

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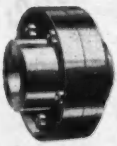

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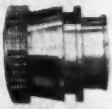

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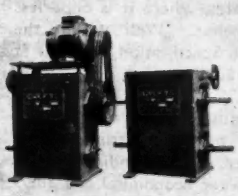

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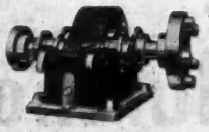

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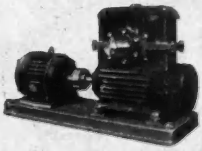

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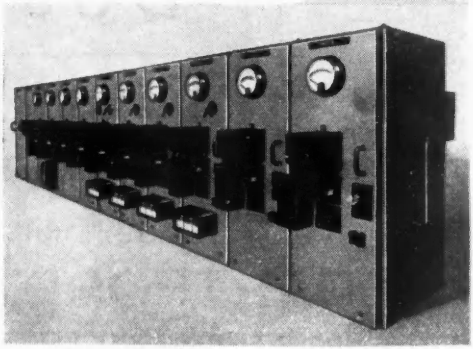

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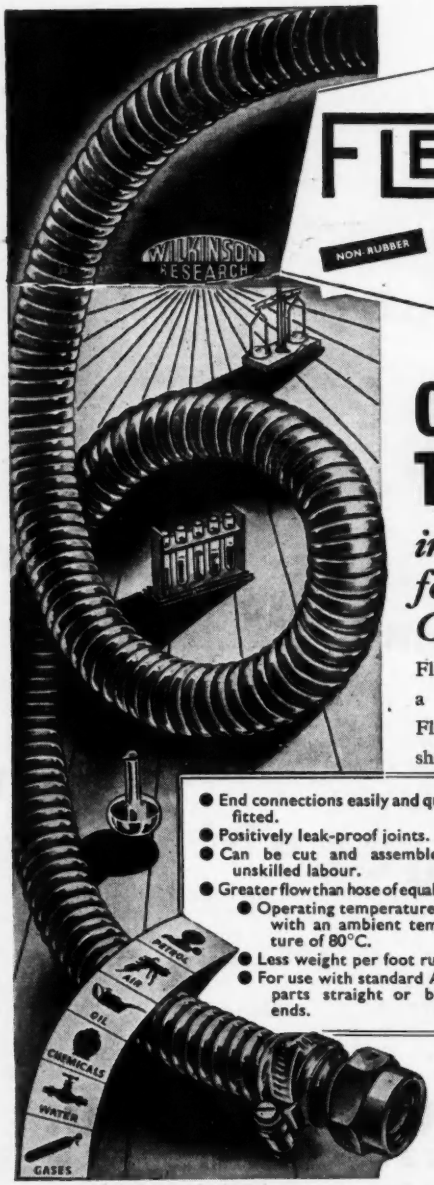

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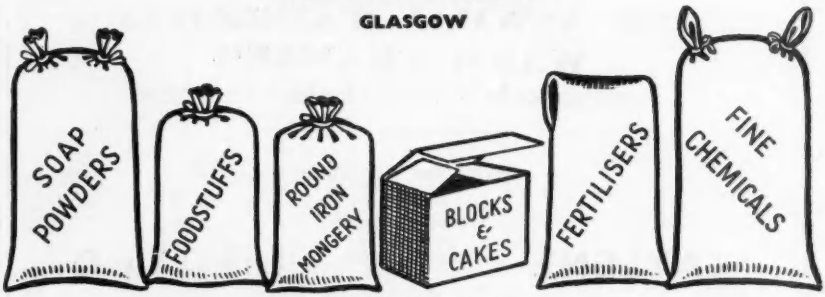

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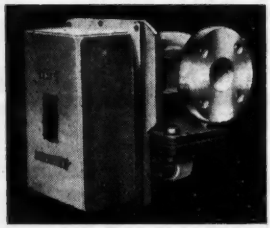

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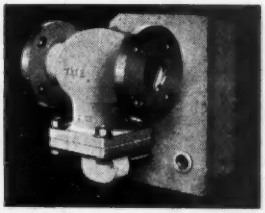

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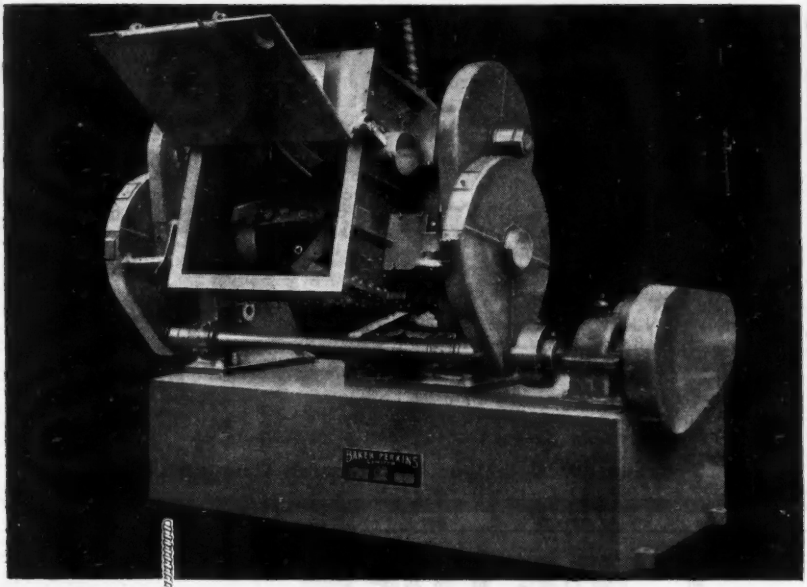

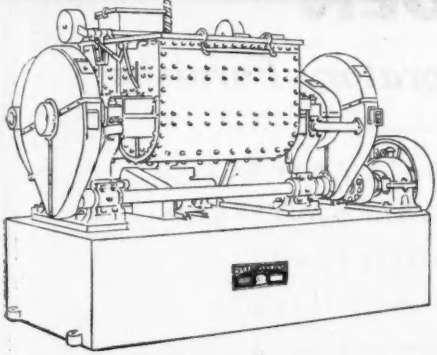

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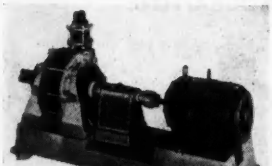

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Size	Port Sizes		Normal Rating 1735 r.p.m.		Normal Rating 1150 r.p.m.	
	Suction	Discharge	G.P.M.	Head in Feet	G.P.M.	Head in Feet
Model A—No. 3	2"	1½"	55	57	50	22
Model A—No. 4	2"	1½"	100	107	80	44
Model A—No. 5	4"	2"	220	52	180	22

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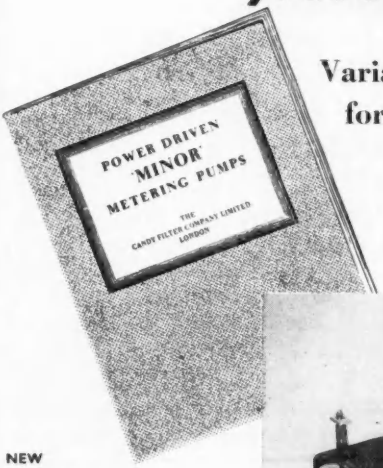

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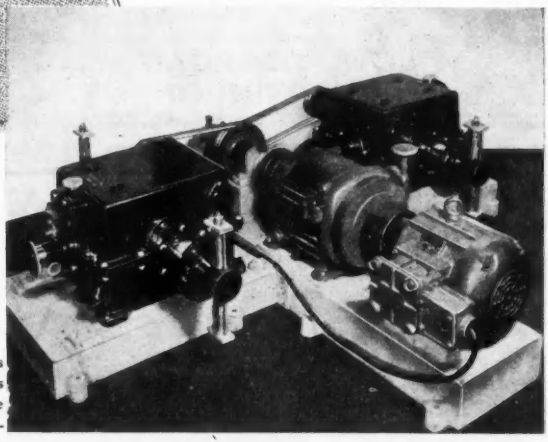

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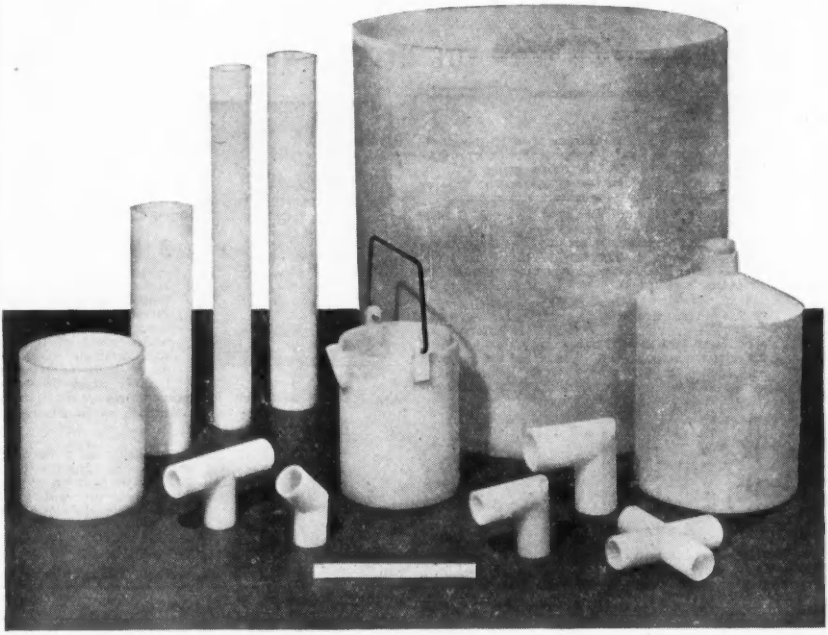

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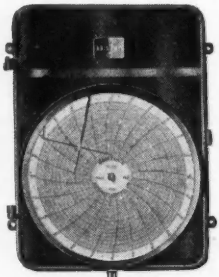

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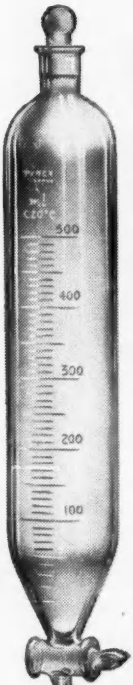

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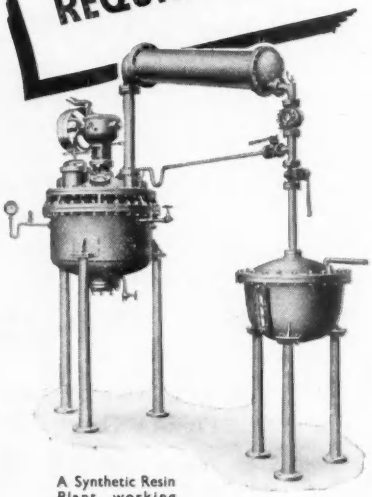

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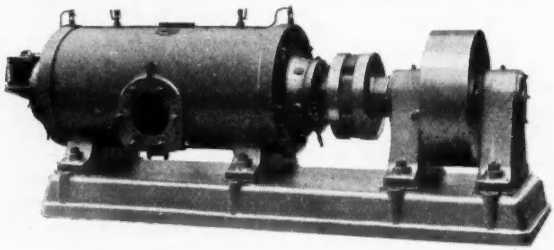

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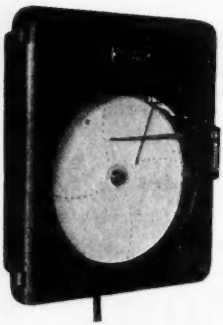

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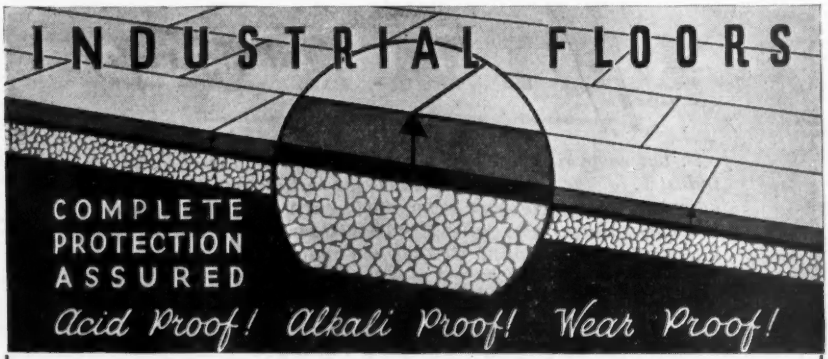

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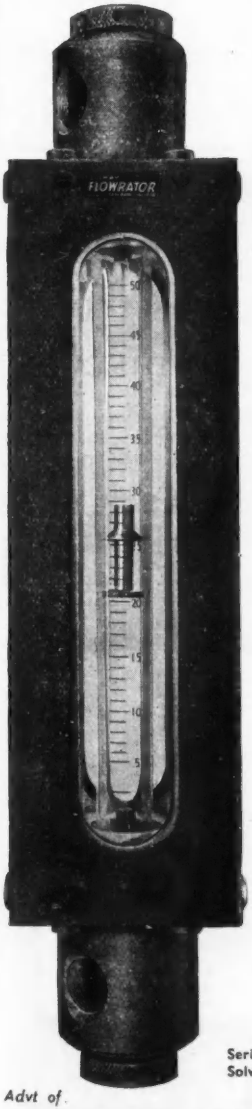

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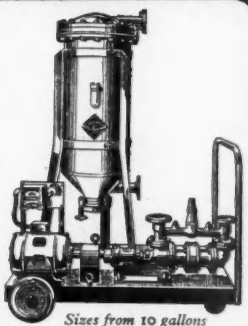

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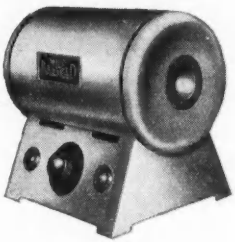
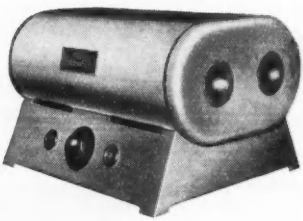
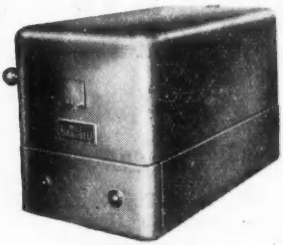


M.91



M.94



M.254

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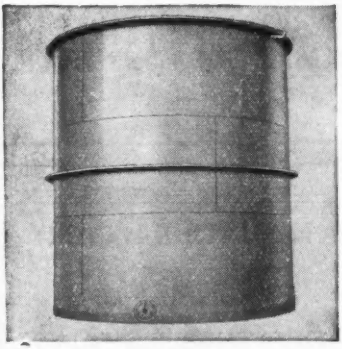

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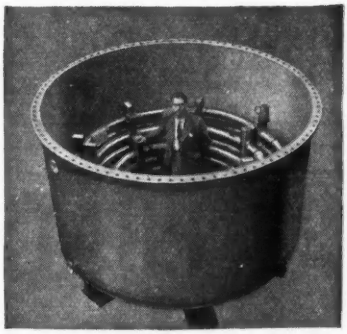

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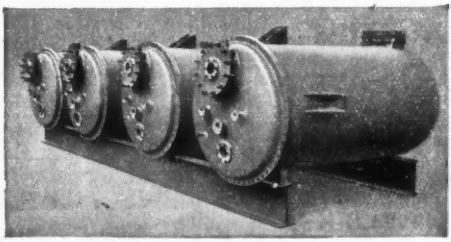

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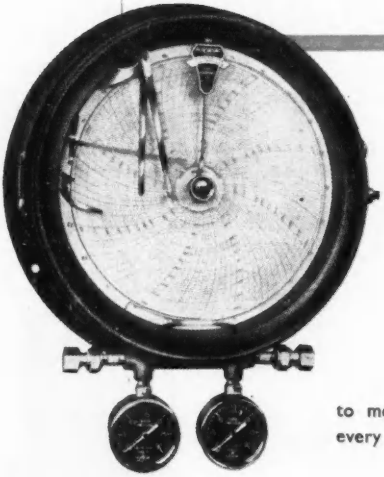

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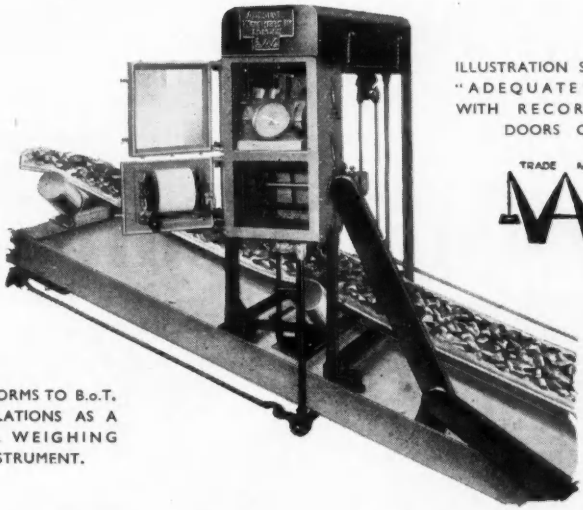

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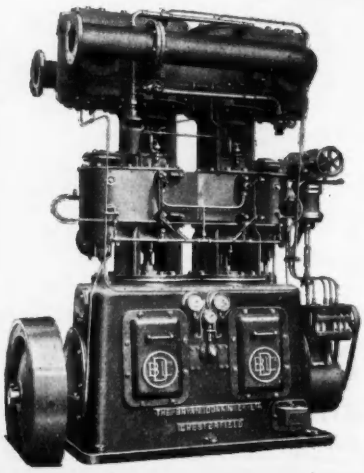

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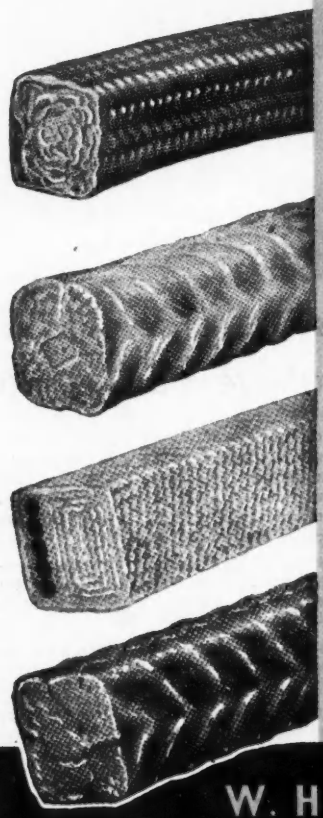

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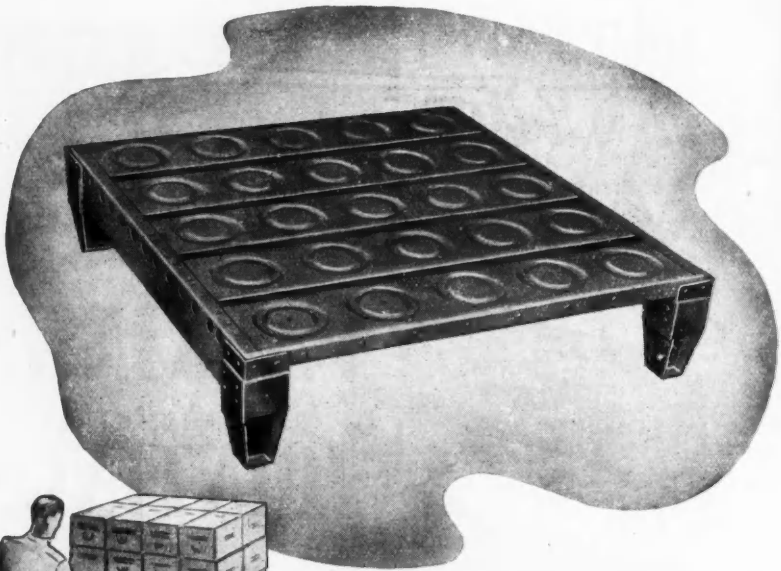

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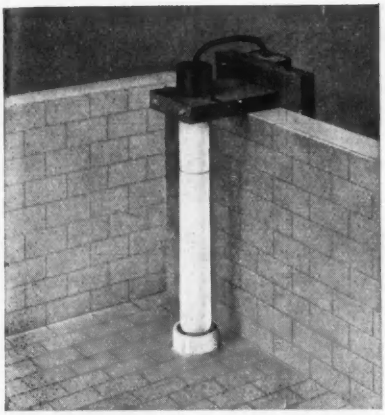

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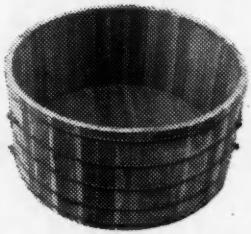

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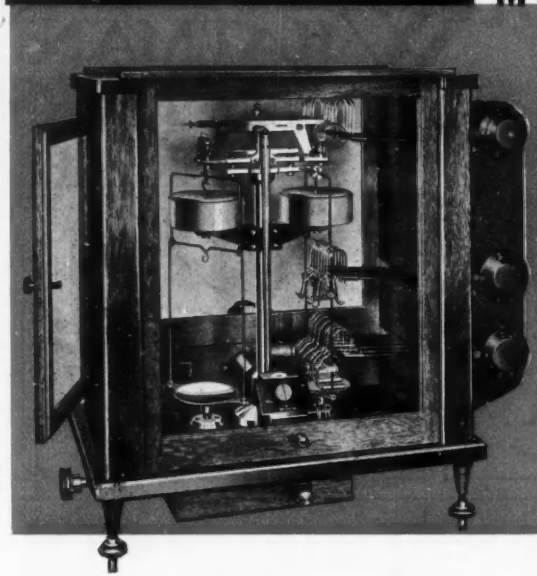

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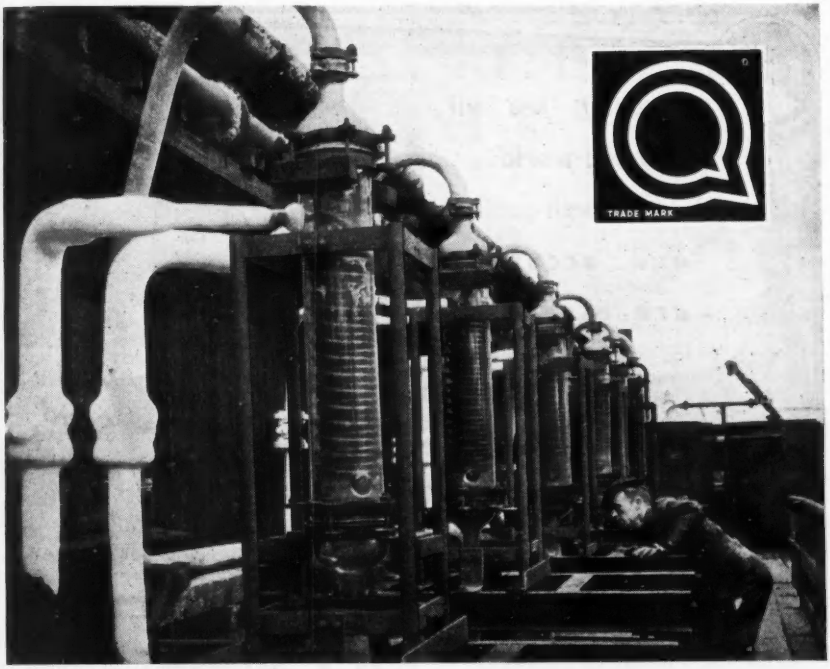

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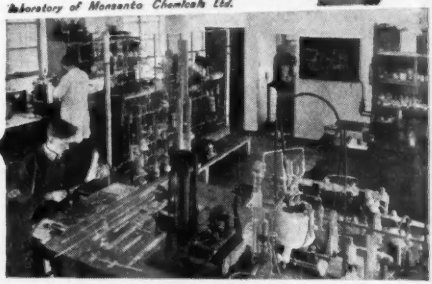

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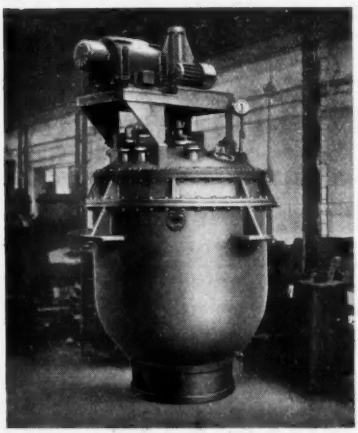

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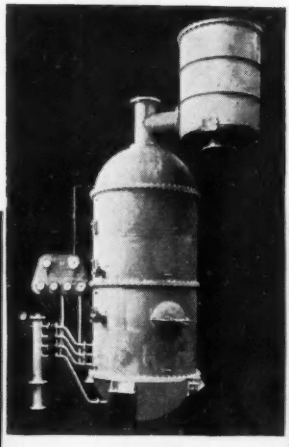

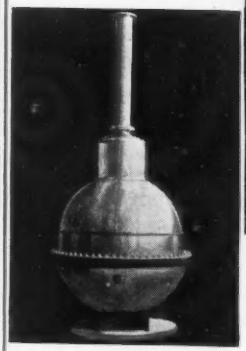

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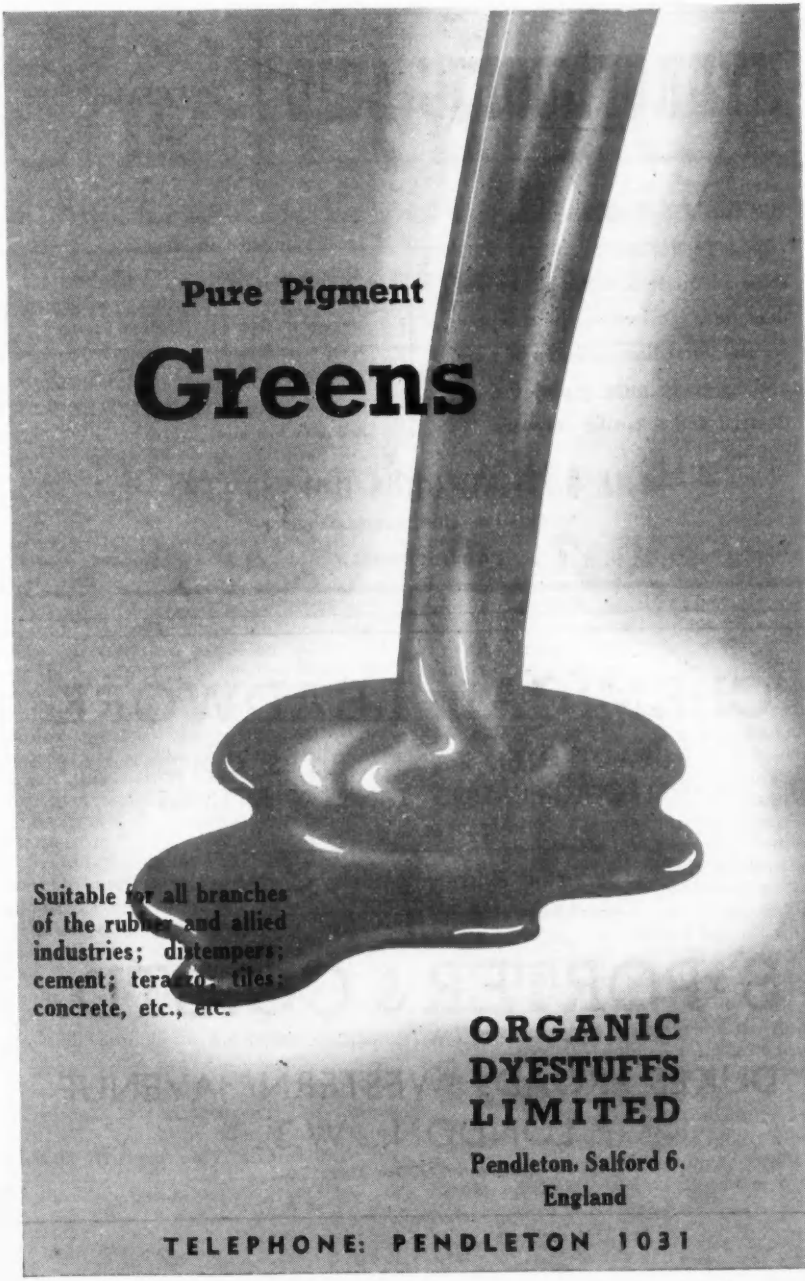
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Volume LXII 14 January 1950 Number 1592

Devaluation's Other Face

A CURRENT issue of a U.S. chemical journal* has analysed the effects of European devaluation upon American chemical industry. The occasion calls to mind Burns's time-honoured lines, for we are enabled to see ourselves and our opportunities as competitors see them. The companion couplet: "It wad frae mony a blunder free us, and foolish notion," may be even more appropriate. The fundamental fact, which this article certainly does not disprove, is that the American manufacturer is a determined, unconditional competitor, and a very efficient one. If U.S. aid to dollar-deficient countries directly invites the export of American goods, he is going to fight tooth and nail to get his share of the business. If U.S. policy or inequality of currencies invites the landing in America of goods from dollar-seeking countries, he will fight with even more zest to prevent damage to his home business.

Since the £ and many other currencies were devalued the American chemical manufacturer has been worried. If he is offering something that is produced only in the U.S.A. his problem is much less pressing—merely the reverse effect of devaluation in the form of diminished exports. If he is offering something that Europe also produces, such as alkalis or penicillin, then so far as exporting in the world market is concerned the American manufacturer "might just as well have stayed in bed." During the latter months of 1949 the full effects had not been felt. U.S. exporters were still working on old orders, but a marked thinning of new orders was being experienced. Chemical plant manufacturers shared that experience, but for them the competitive effects of devaluation were reduced by American ability to offer earlier delivery dates and by the advantages conferred by advanced American technology. The American producer is not afraid of devalued prices if he can compete with time.

The troubles of producers in the dollar areas vary according to the commodity. In some cases, such as British creosote, it was not expected that cheaper imports (into the U.S.) would follow devaluation; instead, the price would be raised to afford a bigger profit in terms of the £. All commodities which

* Chem. Ind., 1949. 65, 705–6

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were competitively priced before devaluation were expected to follow that course. Similarly, imports not wholly replaced by synthetics in America—rubber, waxes, and botanical chemicals, such as pyrethrum—were unlikely to be greatly affected. But certain chemicals were non-competitive before sterling was devalued and here the currency is being seen as " a wedge to open American doors." Chemicals instanced in the American journal were pyridine, cresylic acid, and naphthalene. Large users were still working on former contracts so that the full effect of devaluation was unlikely to be apparent for a time. Also, it is observed, " Many items carry such heavy tariff levies that devaluation will be ineffective. This is generally true of many fine chemicals such as dyes and pharmaceuticals."

In the longer-term prospect, this American report took considerable comfort from the history of previous currency devaluations. They had always been followed by inflation and temporary advantages were soon cancelled by resulting increases in prices and wages. Even so, the customary pattern of immediate but short-lived benefit to the devaluing country, though probable, is not thought in America to be a certainty. Even as a temporary palliative, devaluation could give time for invalid economies to recover competitive strength, for the establishment of good relationships with new buyers, and the creation of new trade patterns. The conclusion reached was that the adverse effect upon American chemical exports would not be long lived, but the effect upon American imports of European chemicals would be more enduring.

The most lasting effect was considered to be a tendency for increased investment of American dollars in foreign industries. An international company is protected against the effects of currency conjuring. South America had been buying certain drugs from the U.S. After de-valuation the order was transferred to the English associate of the same company. While this was an argument for dollar investments outside the United States, the threat of nationalisation and restrictions upon converting profits into dollars were serious counter-balancing factors.

On the whole, these American reflections on devaluation are more encouraging for us than for the American chemical industry. They are certainly not without useful pointers which can help us make the best of what is, after all, a bad job.

Notes and Comments

Payment by Results

THE provision of "incentives" seems destined to be one of those subjects—in this instance a controversial one—which are always treated in the abstract. The chairman of Imperial Chemical Industries helped to bring the subject to earth when he announced in Birmingham that the chemical group had gone some distance in applying the principle of higher payment for better work and recommended the principle to others. That was in November last, and the story has now been developed a stage further, in evidence of which is a special article in the *Newcastle Journal* last week, dealing with piece rates and work study at I.C.I., Billingham. There, according to the observer in the North-East, the will to work is strong—and is still growing. Nearly 2000 at Billingham are now recorded to have accepted the performance standards determined by the works study department. The traditional fear of unemployment is admitted to have cast a few doubts on the merits of the plan, but the sceptics themselves are becoming convinced "that it is not a trick to get them the sack." Representatives of 14 trade unions are reported to have put their signatures to a plan designed to secure maximum efficiency in all manufacturing processes and plant maintenance, and to put man-power and materials to the most economical use. Some nationalised industries and nationalisers, would do well to take this lesson to heart.

The New Insecticide

THE first full tests of the latest formulation to be used against aphis, the most destructive vector of virus diseases, and some others equally objectionable, seem to leave little doubt that several of the conspicuous disadvantages of other potent insecticides have been overcome. Among the well founded criticisms of DDT arsenic formulations and the rest has been the undiscriminating effects, which, destroying the beneficial predators as well as the aphis or red spider, have been accused of the capacity to do more harm than good. Bisol 3, Pest Control's name for bis (bis dimethylamino phosphonous) anhydride ($C_8H_{24}O_3N_4P_2$), is stated to be systemic and selective, so that it remains within the structure of the plant as a comparatively persistent insect poison which, however, does not destroy creatures such as ladybirds. Such wholesale destruction has in the past produced some very disconcerting results in the form of greatly increased populations of resistant strains of the insects it was intended to destroy. The value of the synthesis carried out by these chemists, led by Dr. G. S. Hartley, in collaboration with nine biologists and two medical research workers, appears to have been proved by extensive field trials, here and in the U.S.A.

Poison Risk

AN unfortunate property of all the newer chemical means of attacking insect pests is the possibility of toxic effects, which in some circumstances may be fatal, upon those who spray them or who eat the crop, when the elementary safeguards have been disregarded. The reality of that danger has been proved by some alarming occurrences following the use in the U.S.A. of some of their own products. Synthetic insecticides are accordingly being regarded in the U.S.A. with rather more suspicion than their real defects warrant. The fact that Pestox 3 is to be marketed in the U.S.A. by the Dow Chemical Company would seem to imply a greater confidence than is enjoyed by some American products. It is clear, however, that any highly effective new insecticide, including this organic phosphorus compound, demands for its safe use a system of stringent precautions not easy to enforce in agricultural and horticultural work. One of the indispensable pre-

cautions in the use of Pestox 3, for example, is that no crop should be treated within six weeks of harvesting. After six weeks the phosphorus compound breaks down into non-toxic phosphoric acid and dimethylamine. The danger of prolonged exposure during spraying is real enough, however, and the originators of Pestox 3 have been at pains to emphasise the need for full protection.

Founding a Steel Industry

NOW that making steel is in danger of becoming an object of State enterprise—if any—it is apt to recall one of many stalwarts to whom English steel and a great many other dependent materials owe their existence today. William Edgar Allen became a steelmaker for the excellent reason that he was dissatisfied with the tool steel he was buying for his own small business in Sheffield and was confident he could do better. How Allen, with a little capital, bought in 1867 the small steel works of Hoole Staniforth & Co., and began making steel and files himself has now been recalled in "The Edgar Allen News." Taking advantage of the rapid development of the railways in Southern Europe, William Allen quickly secured a good connection there which helped to promote industrial development and to increase the demand for steel. His reputation for honesty and attention to his customers' interests was soon known throughout the Continent. At home, too, Edgar Allen & Company was growing so rapidly that it soon required a private company and, in 1900, a public limited company, at Tinsley, to administer its expanding affairs. The Imperial Steel Works developed soon afterwards the Tropenas process of converting steel and became the pioneer of steel castings for electrical plant. The growing process has been more or less continuous ever since and the company is today operating one of Britain's largest steel foundries. Edgar Allen, before he died in 1915, was not content merely to produce good steel. The city of Sheffield preserves some of his other good work, including a library at the University and an institute for the treatment of rheumatic and other disorders.

Re-designed Furnace for Carbon Black Process

ONE of the firms closely identified with the introduction in this country of carbon black production on a large scale from petroleum sources is the applicant for an English patent (631,736) for an improved process and apparatus for black production. The invention, in the name of Phillips Petroleum Company, relates principally to a redesigned furnace associated with the methods described in the patent application 22,219/45.

In the production of carbon black by the so-called furnace method some processes are dependent on partial combustion of charge stock for the heat required; in others the heat is provided from a separate source—within the furnace or in a separate pre-heating furnace, or both.

In the present invention the furnace comprises a cylindrical chamber, closed at one end, and having a partial combustion zone; a central pre-heating tube extending through this zone and burner for injecting combustible gases into the pre-heating zone tangentially to walls of chamber. Within the tube is a cylindrical body to form an annular space between it and the tube walls, and this space may be of irregular diameter. An additional tangential burner may be included in the combustion zone.

A gaseous hydrocarbon charge is introduced axially into the cylindrical furnace chamber and part of this charge is converted into carbon black by heating and the injection of combustible gases (containing oxygen) tangentially to the inner wall. The velocity is sufficient to tend to dispose gases by centrifugal force against the inner surface of the wall adjacent to which the gases are burned. The incoming charge is directed through an annular space in a gas-tight conducting tube extending through the greater part of chamber, so that the charge is rapidly pre-heated and discharged axially in relation to the rest of furnace chamber. The yield of black is said to be substantially increased. The charge is preheated to 1800-2000° F., at which there is a content of 8-10 per cent olefins.

ATOMIC PATENTS RELEASED

67 Processes Disclosed in the U.S.A.

INAUGURATING a new programme to make non-secret technological information available for use by industry, the U.S. Atomic Energy Commission has released 67 of its patents to the U.S. Patent Office as patents available for sale. The commission will grant royalty-free licences and has authorised the Patent Office to prepare abstracts of the patents.

Among the 67 inventions first listed are patents covering mass spectrometer system, torsion balance, apparatus for storage of fluorine, welding or cutting metal by hydrogen-fluorine flame, production of fluorine, purification processes, ionisation, neutron meter, azeotropic distillation, preparation of uranium hydride and uranium monocarbide, producing calcium hydrides by distillation, alkali metal compounds, radiation measuring devices, chlorinated hydrocarbon, method and apparatus for control of beam energy, and nitrogen purification process. They cover a three-year period, October 29, 1946, to November 8, 1949.

£6.5 m. for Shell Research

AN allocation of £6.5 million for research in 1950 has been made by the Royal Dutch Shell group of companies, Shell is credited with having, in the U.K., the U.S.A. and Holland, some of the most modern and best equipped laboratories in the world, in which 3500 research workers are engaged in discovering new uses for the oil products and chemicals derived from crude oil, or seeking to improve their performance.

An important branch of this work is chemical research, which has made available a number of chemicals from petroleum. Already, plants are producing a considerable range of chemicals (solvents, plastics, detergents in particular) at Stanlow (Cheshire) at Pernis (Holland) and at a number of centres in the U.S.A.

Chadwick Public Lectures

River pollution and the River Boards Act, 1948, will be the subject of a lecture by Mr. Charles E. Scholefield to be given at the London Missionary Society, 42 Broadway, Westminster, London, S.W.1, on Tuesday, April 4 at 2.30 p.m. This is one of the 38th annual series of Chadwick public lectures being given between February and June.

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WORLD CONGRESS

Analytical Chemists in London

THE plans for the holding of an International Congress on Analytical Chemistry in Britain in 1952 have been carried a stage further since the intention was announced in August last.

An approach has been made to the council of the International Union of Pure and Applied Chemistry for its patronage, to which the International Union agreed at its meeting in Amsterdam in September. The International Union noted that the proposals were in accord with one of the major decisions taken at that meeting, viz., the formation of six autonomous sections, one of which would be concerned with analytical chemistry.

It is likely that a meeting of the board of this provisionally constituted section on analytical chemistry could be arranged to coincide with the Analytical Congress in Britain.

Preliminary Discussions

The executive committee, under the chairmanship of the president of the Society of Public Analysts and Other Analytical Chemists, Mr. G. Taylor, has had preliminary discussions regarding location of the congress, publication of the papers, etc., and a sub-committee is studying the scope of the subjects to be discussed.

Sir Wallace Akers, C.B.E., is to be chairman of the finance committee and the general committee has the benefit of the advice and help of the president of the Royal Society, Sir Robert Robinson, O.M., who continues to act as chairman of the general committee.

The honorary secretary of the congress is Mr. R. C. Chirnside, Research Laboratories of the General Electric Co., Ltd., Wembley.

£2.5 m. for Salt and Chemicals

THE Murgatroyd Vacuum Salt Co., Ltd., which operates a substantial undertaking at Middlewich, is the principal of a new £2.5 million salt and chemical works being built at Tetton, near Sandbach, Cheshire, on a 40-acre site. It is expected to be in full production by next summer. The Congleton Rural Council and the urban councils of Sandbach and Middlewich have been asked to build houses for 200 workers and executives. The factory, which has the financial backing of the Treasury, is intended to play an important part in the export drive.

SYNTHETIC OIL ADDITIVES

Complex Modern Compounds

INCREASING importance is now being attached to the use of chemical additives in lubricating oils in order to improve their efficiency. Generally speaking these additives set out to procure these properties:—

Improve the oiliness of both mineral and vegetable oils; increase their film strength (this is most important as the use of smaller gears and greater power in modern cars has increased the gear tooth pressure to a point where in many cases pure petroleum lubricants are no longer able to protect the metal surfaces adequately); increase the resistance of oils to oxidation; inhibit the oxidation of bearings and other metal surfaces; increase the detergent dispersant properties of oils; improve the viscosity index.

Seldom does one additive alone meet all these requirements and manufacturers make use of a range of compounds, each being able to contribute certain characteristics to the oil, *e.g.*, to improve film strength use is now being made of tetramethyl or tetraethylthiuram disulphide; 1 per cent of one of these can increase the film strength of lubricating oils several times.

Special Properties

Some additives which claim to improve oiliness are essentially phosphite esters of alkylated phenols, one of which now on the market has a specific gravity of 1.04 at a stable 60°F. and on analysis gives 5.7 per cent phosphorus; 0.22 per cent of nitrogen and 0.5 per cent chlorine.

The additives, which are required to operate mainly as detergents in crankcase lubricating oils, are extremely complex metallo-organic compounds of the sulphurised alkyl phenol type containing about 4 per cent barium and 0.9 per cent sulphur. The presence of barium is considered to be most desirable.

Pure hydrocarbons of high viscosity are usually recommended for improving the viscosity index of oils; metallic naphthenates have also been used.

The general requirements of oil additives may be summarised thus:—

Solubility in lubricating oils throughout a wide temperature range; high stability throughout operating temperatures; high flash point, preferably about 400°F.; light colour; low viscosity unless used to increase viscosity; devoid of any objectionable odour; non-dermatitic.

PHARMACEUTICAL EXPORTS

Group Officers Appointed

THE following are the principal officers of the council and executives of the Association of British Pharmaceutical Industry required by the reorganisation of the association following the merger with the Pharmaceutical Export Group: President, Mr. R. L. Taylor (Johnsons of Hendon, Ltd.); vice-president, Mr. J. C. Hanbury (Allen & Hanburys, Ltd.); immediate past chairman, Mr. C. A. O. Rideal (May & Baker, Ltd.); hon. treasurer, Mr. H. C. H. Graves (Vitamins, Ltd.); trustees, Mr. H. J. Baker (Duncan Flockhart & Co., Ltd.), Mr. J. Stuart Hills (John Bell Hills & Lucas, Ltd.), Mr. J. W. Wigglesworth (Wigglesworth, Ltd.).

A council of 25 members was appointed, a home executive, under the chairmanship of Mr. C. Mervyn Hill (British Drug Houses, Ltd.), and an export executive of 14 under the chairmanship of Mr. G. W. Miller (Burroughs & Wellcome & Co.).

Competition with U.S. Chemicals

AMERICAN security may be jeopardised by over-generous aid to Western Germany and other countries receiving Marshall Aid, according to George W. Merck, president of the Manufacturing Chemists' Association, Washington. In a survey of the chemical industry in 1949, published in *Chemical and Engineering News*, Mr. Merck gives warning that foreign competition is becoming a major threat to continued chemical progress in the United States and that too extreme a policy of co-operation with war-impoverished nations may prove a costly boomerang, reducing American chemical output and creating wide employment. Many countries contemplated using Marshall Aid dollars for further expansion of their output of chemicals, dyestuffs, fertilisers, and plastics.

Purchase Tax and Exemptions

A revised list of drugs, medicines and simple chemical compounds subject to purchase tax and non-proprietary unbranded, preparations of official substances which are exempt from tax has been issued by the Commissioners of Customs and Excise as Notice No. 78B. January, 1950 (Drugs and Medicines). This supersedes notices Nos. 78B (October, 1946); 78M (April, 1948); and 78N (January, 1949).

CONTINUOUS SOAP MAKING

*Current Attempts to Avoid Batch Processing**

by A. H. CHARLTON

CONVENTIONAL soap-making is essentially a batch process. For many years, the technicians in the industry have endeavoured to work out a process which will make soap continuously, and over the past 75 years many patents have been taken out with this end in view.

Mostly the claims made for the continuous process relate to saving in costs from fuel, labour, floor space, etc., but few of them make specific claims that the quality of the soap so produced is equal to or even better than that produced by the time-honoured method.

To make soap by the continuous process it is necessary in the first place to devise a means for the correct amounts of fats and caustic soda to meet at a given point at which they are for all intents and purposes instantaneously turned into soap. This part of the process can be achieved with relative ease, but it has to be remembered that we have only produced at this point a mixture which contains soap and glycerine, and it is important that both for quality and economic reasons, the glycerine be removed from the mixture.

Spray Method

Among suggestions put forward to achieve this, one is that the mixture shall be sprayed through an atomised nozzle into heated air at such a temperature that the soap will lose its moisture and fall to the bottom of the spraying tower in the form of fine powder, while the glycerine and water will evaporate, the mixed vapours to be subsequently collected and condensed.

This, probably, is one of the least satisfactory processes, because the soap has not had the nigre separated from it and there is some doubt as to the overall efficiency of the glycerine recovery.

Another method is to remove first the glycerine from the fatty material by a splitting process in which the fats are split into fatty acids and glycerine. The glycerine is washed out by water from the fatty acids and the latter are then passed to a continuous soap-making plant. The product of this is sprayed into a heated tower through an atomising nozzle, the dried soap itself being collected at the bottom.

Here, again, the soap has not had its nigre removed, but is mainly suitable for use in making soap powders by mixing with alkali, preferably before spray drying. It is claimed that the pure dried soap can be hydraulically pressed into toilet soap tablets, but there is considerable variance of opinion as to whether toilet soap made by this method compares favourably with that made from soap manufactured by the boiled process.

Centrifugal Saponification

One of the latest methods of producing soap by the continuous process is the one in which the fats and oils are first blended and then accurately mixed in correct proportions with caustic soda solution and passed through a high-speed centrifugal machine. This is claimed to cause instantaneous saponification.

The soap from this centrifugal machine meets a current of brine which washes out the glycerine, the soap passing on to a second centrifugal machine which removes the excess of salt. The soap now meets a solution of caustic soda which ensures that all the fat is fully saponified and passes on to a third centrifugal machine, which removes most of the caustic soda. In a fourth similar machine a controlled amount of water is added to the mass. This is claimed to render the soap in the same condition in the boiled process as it would be after fitting in an ordinary copper.

In the boiled process, gravity separates the nigre and impurities from the soap. In the continuous process, the soap passes through centrifugal machines, in which, it is claimed, the mixture is separated into neat fitted soap and nigre.

The process outlined, would appear to be highly possible, but as far as can be seen at the moment, it ignores the desirability of allowing the soap to lose temperature from 212°F. to 170/150°F. This loss of temperature occurs in the boiled process during the period of rest after fitting, occupying two or more days. It is during this period that many physical alterations occur to the soap mass, which in the opinion of most soap-makers are essential, particularly for the production of a first-class toilet soap. It would seem, therefore, that this process is suitable for all purposes, except quality toilet soap.

* Abstract of a paper, "Modern Methods of Soap Manufacture," presented recently before South Eastern Counties Section of the Royal Institute of Chemistry.

Fuller Use of Non-Ferrous Metals

November Stocks Reduced

CONSUMPTION of non-ferrous metals was higher in November than in the previous month and closing stocks at the end of the period, except those of tin metal, again showed a decrease.

November production of unwrought copper and unwrought zinc was lower than in October, but there was an increase in the output of main copper, alloy and products, lead and tin metal.

Details of production, consumption and stocks abstracted from the summary issued by the British Bureau of Non-Ferrous Metal Statistics included these:—

UNWROUGHT COPPER

	Long Tons	
	Blister Copper	Refined Copper
OPENING STOCKS:		
Govt. and consumers	52,568	91,299
Imports	7,001	12,781
PRODUCTION:		
Primary	—	9,348
Secondary	2,046*	6,149
CONSUMPTION:		
Primary	9,444	28,659
Secondary	—	14,989
Exports	2,891†	23
CLOSING STOCKS:		
Govt. and consumers'	50,570	86,036

* Rough Copper.

† Includes 1517 tons rough copper dispatched to Belgium and 1315 tons rough copper to Germany for refining on toll.

GROSS OUTPUT OF MAIN COPPER, ALLOY AND PRODUCTS

Unalloyed copper products	25,852 long tons
Alloyed copper products	25,260 ,, ,,
Copper sulphate	3,931 ,, ,,

UNWROUGHT ZINC

	Long Tons	
	Zinc in Concentrates (estimated gross Zinc content)	Slab Zinc (all grades)
OPENING STOCKS:		
Govt. and consumers'	39,888	65,114
Imports	3,630	13,806
PRODUCTION:		
Virgin and remelted	—	4,800
CONSUMPTION:		
Virgin (incl. debased)	6,141	19,586
Remelted and scrap	—	7,995*
Exports and Re-exports	—	10
CLOSING STOCKS:		
Govt. and consumers'	37,377	64,169

* Includes small quantity of zinc in concentrates consumed directly for chemicals, etc.

LEAD

	Long Tons			
	Lead in Concentrates	Imported Virgin Lead	English Refined	Lead Content of Secondary Scrap and Residues
OPENING STOCKS:				
Govt. and consumers'	—	57,348	2,277	—
Other stocks	70	—	—	—
IMPORTS	—	9,632	—	30
PRODUCTION	202	—	2,435	—
CONSUMPTION	219	15,714	2,563	12,491
Exports	—	39	—	—
CLOSING STOCKS:				
Govt. and consumers'	—	53,001	2,149	—
Other Stocks	53	—	—	—

TIN METAL

	Long Tons
GOVT. AND CONSUMERS' STOCKS (at end of period)	15,765
IMPORTS	—
PRODUCTION	2,715
CONSUMPTION	1,878
EXPORTS AND RE-EXPORTS	483

ANTIMONY

	Long Tons
TOTAL CONSUMPTION OF ANTIMONY METAL AND COMPOUNDS	439
TOTAL CONSUMPTION OF ANTIMONY IN SCRAP	368

CADMIUM

	Long Tons
TOTAL CONSUMPTION OF CADMIUM	46.90

Rapid Steel Analysis

SCIENTISTS of the research laboratory of the United States Steel Corporation have adapted the Geiger counter, used to detect uranium and other radioactive materials, to the development of a quick and accurate method of analysing steel samples.

After careful calibration, Geiger counter analysis is expected to be even faster than the direct-reading spectrograph, itself a comparatively recent development in metallurgical analysis. Used in conjunction with special spectrographic equipment in laboratory studies, the counter has achieved a measure of success in quickly revealing the kind and quantity of alloying elements in steel. It measures the distinctive fluorescent rays that emanate from a steel sample of which the atoms have been ionised by X-ray.

In the research laboratory at Kearny, New Jersey, the instrument is connected to a self-balancing potentiometer, which plots the proportions of the elements.

This new and fast method of steel analysis promises marked advantages in the laboratory, and a still more important usefulness, when fully articulated, to assist the operator of a steel-making furnace to know quickly, at various steps of his furnace's heating cycle, whether he is getting the exact steel composition required.

Some News Events of 1949

Chemical industries are entitled to look back on 1949 as the year in which more progress was made towards the re-establishment of normal conditions, relatively more favourable than those of its predecessors to the formation of firm policies for peacetime production. The absence of acute fuel shortage, rather more stable supply conditions and the removal of a number of Government controls were important factors helping to offset the element of uncertainty which had discouraged the formulation of long-term plans. The readiness of industries to take full advantage of any approach to normal conditions was reflected in many schemes to widen the scope for research and for the development of new materials, to which this news summary bears witness.

JANUARY

THE possibility of deriving a wide range of chemical materials from a new source, the sisal plant (*agave sisalana*), was announced, following experimental work at Gerrards Cross (Bucks.) by the A.S.P. Chemical Co., Ltd.

The three organisations representing the manufacture of paint made a joint recommendation to their members to reduce prices in the home markets as from January 1, 1949.

I.C.I., Ltd. purchased the ammonia and hydrogenation sections of the chemical factory at Heysham (Lancs.), which it had operated as managers for the Government.

A pilot plant of the Minnesota Mining and Manufacturing Company, St. Paul, Minn., U.S.A., started the first commercial production in America of fluorocarbons.

Dr. D. G. Davey, who shared with the late Dr. Curd the leadership of the research which yielded Antrycide

Encouraging preliminary results with the new I.C.I formulation, Antrycide, a drug to protect cattle from the ravages of the disease spread by tsetse fly, was announced by the Colonial Office in conjunction with I.C.I., Ltd.

An important step towards extending the possibilities of protecting metal surfaces with rubber, was noted by the British Rubber Development Board. Dr. W. H. J. Vernon, of the DSIR Chemical Research Laboratory, Teddington, indicated some important water soluble rust inhibitors, of which sodium benzoate is the best known example.

Production of scientific instruments began at the Watling Street, Motherwell, factory which was taken over by Metropolitan-Vickers, Ltd., and Newton Victor, Ltd., a year before.

With the location by the Northern Chemicals Company, a subsidiary of the Lithium Corporation of America, of a large deposit of spodumene, the principal ore of lithium, 90 miles north-west of Winnipeg, a new industry was announced as being formed which may make Canada the world's leading producer of lithium.

The completion of 50 years' expanding activity was celebrated by Borax Consolidated, Ltd.

The development of a new insecticide, TEPP (tetraethyl pyrophosphate), for the control of aphids, mites and other plant pests, was announced by Albright & Wilson, Ltd.

A military security board, directly responsible to the three Commanders-in-Chief of the Western Zones, was established to prevent the revival of militarism and the creation of a war potential in Western Germany. The board was charged with ensuring that scientific research is not directed to warlike ends and that laboratories or factories are used only for peaceful purposes.

Further plant in Western Germany earmarked as reparations included that of Remynolwerke—a lead factory at Bendorf—and the Knoll alkaloid plant at Ludwigshafen.

Plant from the chemical factory at Anorgana, in Gendorf (Germany), was divided between France, Czechoslovakia, and Jugoslavia under the reparations scheme.

Work of dismantling was reported to be in progress at 195 plants in Germany, the total of completely dismantled plants to date being 235.

The experimental production in Britain, in 1950, of atomic power in a form suitable for industrial purposes, was envisaged by Sir Wallace Akers, a director of Imperial Chemical Industries, Ltd.

The conclusion in Warsaw of a five-year trade and finance agreement between Britain and Poland was announced.

The Liverpool Chemists' Association celebrated its centenary.

E. I. du Pont de Nemours and Co., Inc., (U.S.A.), announced its preparedness to licence competitors to use its Cellophane patents gratis to help meet the growing demand, and undertook to help prospective competitors by the loan of key technical personnel and in other ways.

Lye, being manufactured by A. Boake, Roberts & Co., Ltd., was introduced as an absorption agent for weak acid gases. It had been used successfully to replace the German pre-war supplies of Alkazid DIK and Alkazid M.

The introduction of a new analgesic Heptalgin (4-4 diphenyl 1-6 morpholino-heptan - 3 - one - hydrochloride) was announced by Glaxo Laboratories, Ltd., Greenford, in whose research establishment it was evolved and synthesised.

The value of chemical exports in December 1948 was announced as £7,347,063 compared with £5,916,489 in the corresponding month of the previous year. The total for the year 1948 (all chemical groups) was £83.6 million (1947 £67.4 million). Exports of the industry for the first month of 1949 reached a new high level with a total value of £8,212,770, compared with £6,756,587 in January 1948.

Personal: Sir Thomas Merton, Sir Edward Salisbury, Sir James Chadwick and Prof. A. C. Hardy were appointed vice-presidents of the Royal Society for 1949. Sir John Russell became the 111th president of the British Association. Mr. Elmer R. Ramsey succeeded Dr. J. Van Nostrand Dorr as president of Dorr Company of the U.S.A.

Mr. E. A. O'Neal, Junr.

Mr. Edward A. O'Neal, Junr., became chairman of Monsanto Chemicals, Ltd., of which he was managing director.

In the New Year Honours list the sciences and chemical industry were not singled out for distinctions. However, Sir John Boyd Orr, recently director-general of the UN Food and Agriculture Organisation, was created a baron; William G. Ogg, director of Rothamsted Experimental Station, and Henry Guy, chairman of the mechanical engineering research organisation of DSIR, became knights; the order of G.C.B. was conferred on Sir Henry Tizard, chairman of the defence research policy committee of the Ministry of Defence, and the C.B.E. on Colonel W. C. Devereux, managing director of Almin, Ltd., and chairman of International Alloys, Ltd.

Obituary: Mr. Geoffrey Fertel, Lord Melchett, Mr. Bernard W. Methley, Dr. John Percival. Mr. Herbert W. Rowell, Mr. Richard M. Stothert, Mr. Ernest M. Baker, Mr. Douglas J. Birdsall, Dr. R. L. Dodds.

FEBRUARY

A DEFENCES Services Research Facilities Committee was set up to "consider proposals for the use of Service facilities and personnel for assisting scientific research." The initiative came from the Royal Society.

Pilkington Brothers, Ltd., glassworkers, of St. Helen's, acquired a majority holding of the shares of James H. Jobling and Company, of Sunderland.

A further step in its already extensive programme for the encouragement of the study of textile technology and science

was the Textile Institute's offer of a new open scholarship worth up to £1000.

The pioneering development in Manchester of supplementing the town gas supply by the use of residual gases from oil refining reached the productive stage when the Manchester Gas Department took 140,000 cu. ft. of rich oil gas by direct pipe-line from the new petroleum chemicals plant at Partington of Petrochemicals, Ltd.

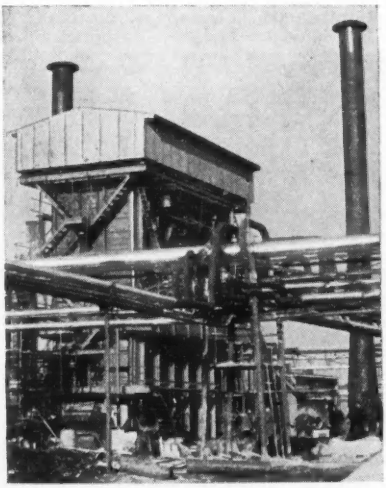
A Dublin and District Section of the Society of Chemical Industry was formed at a meeting in Trinity College, Dublin.

The British Dyewood Company, Ltd., Glasgow, celebrated its centenary.

Exhibited at the Textile Industry Exhibition, Manchester, was a new development in colour matching—a unit composed of two blue fluorescent and two ordinary lamps, the light of which is mixed and diffused through a Perspex screen.

The revocation was announced of all remaining orders controlling the production, distribution, acquisition and disposal of fertilisers.

A skin disease which swept through Central Baden, in the U.S. zone of Germany, was traced to phosphorus on the ignition strips of certain match boxes.



The first furnace put into operation by Petrochemicals, Ltd., at Partington, Manchester, serving the new Catarole process to provide petroleum-based chemicals

Investigators found that when boxes were carried in trouser pockets vapour from the igniters caused inflammation, which became worse if exposed to other chemical elements.

Laboratory tests were reported as being carried out with a new antibiotic drug, diplomycin, discovered by Dr. Karl Noster, a German bacteriologist. Patients in several Hamburg hospitals were undergoing treatment with the drug for various diseases, including tuberculosis of the lungs.

A Home Office amendment of the Poison List and Rules, relating to the indication of character to be prescribed for the labelling of agricultural and horticultural insecticides and fungicides containing dinitrocresols and certain phosphorus compounds required warnings to ensure safe handling to be printed on packages.

A five-day conference of the International Scientific Committee for Trypanosomiasis was held at the Colonial Office, London. Scientists from Britain, France, Belgium, Portugal, South Africa and Southern Rhodesia attended, and means of promoting further research were discussed.

U.K. chemical exports in February were of substantially less value than those of January. The comparative figures were: January £8,212,770, February £6,737,432. They were, however, well in excess of February 1948 (£5,706,340).

Personal: The British Welding Research Association appointed MR. W. K. B. MARSHALL assistant director of research. SIR BEN LOCKSPEISER succeeded SIR EDWARD APPLETON as secretary of the Council for Scientific and Industrial Research. DR. JOHN F. THOMPSON was elected president of the International Nickel Company, Inc.

Obituary: Dr. Cyril Dustan, Prof. T. S. Patterson, Mr. Alfred Diggory, Mr. James MacGregor, Mr. Edward T. Sterne, Mr. L. V. Kenward, Dr. Moritz Niessner.

MARCH

BRITAIN'S large atomic pile at Harwell was used for the first time for the production of radioactive isotopes and the first deliveries from this source were announced to start early in March.

Regulations made by the Minister of National Insurance added beryllium poisoning to the list of industrial diseases scheduled under the National Insurance (Industrial Injuries) Act.

Further developments in the preparation

of moulded catalysts of exceptional stability, resistance and activity were claimed in two English patents by N.V. de Bataafsche Petroleum Maatschappij.

Part of the anniversary meetings of the Chemical Society, a symposium on the chemistry of the heavy elements (Oxford) was noteworthy for its international character, the speakers including authorities on nuclear fission products from the U.S.A., Canada, Germany, France and Austria and many from this country.

Implementing the decision to divide the undertaking of Brotherton & Company into an operating company and a private investment company with £1,475,000 capital, an offer was made to sell 600,000 ordinary 10s. shares in the former company at £1 each.

On charges that they had conspired to restrain and monopolise world trade in titanium pigments—which they denied—the National Lead Company, E. I. du Pont de Nemours and Co., Inc., and four other defendants were ordered to pay fines totalling $43,000 by the U.S. District Court in New York.

The first practical adaptation of radioactivity to the textile industry was made in Yorkshire and Lancashire mills, to record the absorption of radiation in its bearing on the thickness of cloth.

An improved method for the reduction of a carbon oxide, especially CO, with hydrogen, to form hydrocarbons, using the Fischer-Tropsch synthesis and a fluidised catalyst, was claimed by the Standard Oil Development Co. (U.S.A.) in an English patent application.

The Zinc Develoment Association announced the formation of the Hot Dip Galvanisers' Association, a non-trading body operating from the ZDA headquarters, which had been set up to promote the development of existing and new uses of hot dip galvanised coatings, and to improve galvanising technique.

The Coal Tar Research Association was registered on March 29 as a company limited by guarantee, without share capital, to take over the assets and liabilities of the unincorporated association of the same name.

A gift "not exceeding £15,000" was made by the Rockfeller Foundation to Cambridge University for the purchase in the U.S.A. of equipment to be used in the chemical laboratory under the direction of Prof. A. R. Todd, university professor of organic chemistry.

Furthering its programme of basic research on the properties of matter at extremely low temperature, where many remarkable phenomena occur, a new and usefully improved type of helium liquefier was announced as being in use at the U.S. National Bureau of Standards.

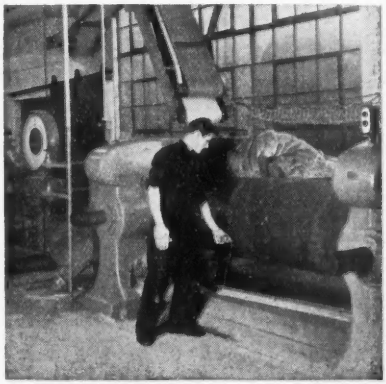
The quantitative determination of phenol and cresol in complex biochemical samples was facilitated through an application of the countercurrent distribution method, as a result of work carried on at Camp Frederick, Maryland, by U.S. Army investigators.

A new laboratory of Organon Laboratories, Ltd., at Newhouse, Lanarkshire, designed to manufacture synthetically vitamins and the whole range of hormones, was officially opened by the Secretary of State for Scotland, Mr. Arthur Woodburn.

The first school in Britain to be built of aluminium was opened at Bristol by Mr. George Tomlinson, Minister of Education.

An event possibly historic in its implications was recorded in the announcement by the Ministry of Supply that plutonium, the highly fissile element made in quantity only in the U.S.A., had been produced at the Atomic Energy Research Establishment, at Harwell.

To stimulate the discovery and exploitation of uranium deposits, particularly in Colonial territories, the Ministry of Supply offered to buy all ores and concentrates and, in certain circumstances, to assist mine development and primary processing by making capital payments. The



Preparing the crude natural rubber for subsequent treatment with hydrochloric acid gas, the new Goodyear Tyre & Rubber Company process for producing a versatile packing material—Pliofilm

offer applied equally to the U.K., although chances of discovering uranium here were considered slight.

The official opening on March 16 of the reconstructed and much extended research laboratory of the General Chemical Division of Imperial Chemical Industries, Ltd., at Widnes, Lancashire, coincided with the completion of 58 years of chemical research there.

A further step in the closer integration of British petroleum refining with the general economic and industrial activity of the country was the opening of a pipeline from the Ellesmere Port (Cheshire) gas works to the nearby petroleum refinery of Lobitos Oilfields, Ltd.

Scientists associated with chemistry or the physico-chemical sciences comprised more than half the long list of Fellows of the Royal Society elected at its meeting on March 17.

The oil refineries at Haifa, which had been in Israeli hands since July 1948, were handed back to British management.

The Danish Finance Council allocated Kr.100,000 for a scientific expedition which was to investigate the deposits of lead recently discovered in Greenland.

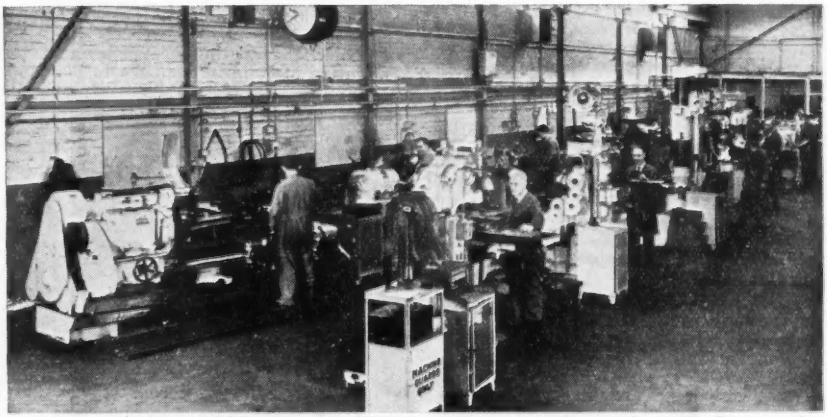
Chemical exports in March (which was a longer working month) reached a value of £7,517,228, compared with £6,651,739 in the corresponding month of 1948.

Personal: SIR HENRY DALE resigned the chairmanship of the British Council's Science Advisory Committee. PROF. SOLLY ZUCKERMAN was appointed deputy chairman of the Advisory Council on Scientific Policy and the Committee on Industrial Productivity. Fine Chemicals Group of the Society of Chemical Industry appointed SIR JACK DRUMMOND as its chairman. SIR ROBERT ROBINSON, PRS., was elected honorary member of the Parliamentary and Scientific Committee. SIR ROBERT SINCLAIR was nominated president of the FBI. DR. R. P. LINSTEAD was appointed to succeed SIR IAN HEILBRON as professor of organic chemistry and director of the organic chemistry laboratories at the Imperial College of Science and Technology.

Obituary: Mr. Charles E. Hodgkin, Sir Thomas Hill Easterfield, Mr. John J. Murphy, Mr. Matthew Forrest, Mr. R. H. Parker, Mr. G. T. Rice, Mr. Charles H. Wilson, Prof. C. H. Lander.

APRIL

IT was announced that the experimental atomic power plant under construction near West Milton, New York, would use liquid metal as a heat transfer medium and produce steam to drive steam turbine generators. The reactor was stated to differ from most previous reactors in the



The largest chemical laboratary in Widnes was part of the newly opened research centre serving the General Chemical Division of I.C.I., Ltd. The comprehensiveness of the service provided is indicated by this workshop section, designed to supply most of the laboratory's needs for special instruments and semi-technical and pilot plants

Professor D. M. Newitt, elected president for 1949 of the Institution of Chemical Engineers

higher energy of the operative neutrons produced by the chain reaction of uranium.

Aluminium stated to be 99.996 per cent pure was reported as being produced at the Vigoland plant in Southern Norway.

An old open-hearth steel furnace near Scunthorpe, of Richard Thomas and Baldwins, Ltd., was demolished and a new all-basic one was constructed in 27 successive working days. This was believed to be a speed record.

The removal of the existing Board of Trade maximum price control of sulphuric acid—battery or accumulator acid, reagent acid and acid containing not more than 25 per cent free SO_3—and the substitution of a new schedule at a lower scale for all other strengths was announced.

Uranium and thorium ore were reported to have been found in Scaler's Hill Colliery, Rochester, Kent.

The difficulty of sustaining payment in dollars and hard currencies obliged the Indian Government temporarily to exclude imports of soda ash.

Tyre treads, claimed to be superior to any formerly manufactured, were reported as having been developed by chemists of Philips Petroleum Company through the use of "cold" rubber and a new type of high abrasion furnace black. The new chemical substance employed was named Diox.

The use of mineral oils as an ingredient in the manufacture of food for sale to the public was prohibited (Mineral Oil in Food Order, 1949).

C. A. Parsons and Co., Ltd., Heaton, Newcastle-on-Tyne, received a further contract for the building of the second steam turbine required for the Ontario Hydro-Electric Commission's new £10 million plant at Toronto, Canada.

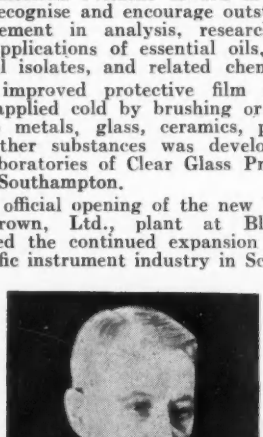
Projects for the modernisation of steel manufacturing facilities in the U.K., Austria and France, and two aluminium foil projects in France, were the subjects of dollar allocations approved by the Economic Co-operation Administration, involving the equivalent of more than £7 million of ECA funds to be available before June 30, with a long-range total of nearly £12.5 million.

The financial and administrative control of the scientific activities of the Imperial Institute, South Kensington, were transferred, as from April 1, to the Colonial Office. Its Empire educational work was delegated to the Ministry of Education.

Sir John Simonsen, director of the British Colonial Products Research Council, was chosen as the first recipient of the American Fritzche Award instituted "to recognise and encourage outstanding achievement in analysis, research, and new applications of essential oils, essential oil isolates, and related chemicals."

An improved protective film (Avigel 100), applied cold by brushing or spraying to metals, glass, ceramics, plastics, and other substances was developed in the laboratories of Clear Glass Products, Ltd., Southampton.

The official opening of the new Honeywell-Brown, Ltd., plant at Blantyre, revealed the continued expansion of the scientific instrument industry in Scotland.



Mr. George Taylor, who was installed president for the year of the Society of Public Analysts

The development was expected to effect a considerable dollar saving and to develop the export trade in recording and regulating equipment.

Personal: MR. C. LORD was elected president of the Association of Tar Distillers. DR. W. HUME-ROTHERY was presented with the Institute of Metals medal for 1949 for work in the science of non-ferrous metallurgy. SIR CLIVE BAILLIEU was appointed chairman of the Dunlop Rubber Company. MR. A. G. GRANT became chairman of the BCPMA. The Meldola Medal for 1948 was awarded by the Society of Maccabaeans to DR. R. A. RAPHAEL. MR. LELAND I. DOAN became president of the Dow Chemical Co. (U.S.A.).

Sir Stafford Cripps, speaking in Edinburgh, announced the Government's intention to finance peat-fuel engine research with an initial sum of £50,000.

To mark the 75th anniversary of the production of soda ash at the Northwich factory of Brunner Mond—predecessor there of I.C.I., Ltd.—in May 1874, a party was given to employees, their families and friends, numbering some 23,000.

The board of the J. R. Geigy A.G., Basle, turned to the Swiss capital market for a 3½ per cent loan of Fr. 12 million. The loan was issued at 99.4 per cent.

The total value of chemical manufactures, excluding drugs and dyestuffs, exported in April (£3,614,873) was £245,266 less than the figure in April 1948.

Obituary: Dr. Friedrich K. R. Bergius, Dr. Williard H. Dow, Mr. Whiston A. Bristow, Mr. W. F. Bowden, Mr. John Irwin, Sir Wyndham Dunstan, Dr. Albert Mylius, Dr. Walter Gygax.

MAY

THE Food and Agricultural Organisation of UNO, implementing the recommendation of the International Emergency Food Committee, announced that the international allocations of nitrogen fertilisers would be discontinued from June 30, 1949.

An important advance in British technology was marked by the Ministry of Supply announcement that radium and radon, sources of highly penetrative gamma rays, could now be supplied for industrial radiography.

The Ministry of Food decided that, from May 22, soap-making licences would be granted to intending manufacturers who were in possession of the plant and facilities.

Colvilles, Ltd., decided to go ahead with one of the largest schemes of steel expansion ever promoted in Scottish metal industries, at a cost of £4.1 million, regardless of the prospect of nationalisation of the industry. The scheme involved extensions at the Clyde Ironworks and the Clydebridge Steel Works, on opposite sites of the River Clyde.

The Massachusetts Institute of Technology announced the granting of scientific and technical scholarships to six British students for the summer course in Cambridge, Mass. There were more than 35 candidates.

Among the many items of scientific interest at the BIF, atomic research, past and present, was represented by characteristic pieces of apparatus on the Ministry of Supply's AERE stand.

The appointment of chemists and physicists to the staff of the Scottish Woollen Technical College, announced by Mr. Arthur Woodburn, Secretary of State for Scotland, marked a further step in the long co-operation between the Scottish woollen industry and the Brtish Wool Industries Research Association, Leeds.

A considerable reduction in the time required for production of uniform neat soap and the like was described in an English patent application, open to public inspection, by Lever Bros., and Unilever, Ltd.

The United Nations International Children's Emergency Fund was reported to have signed a contract with I.C.I., Ltd., Manchester, for the supply of 50,000 vials each containing 3 million units of procaine penicillin, to be used for combating syphilis.

A new research centre of Monsanto Chemicals, Ltd., was opened at Ruabon.

Personal: DR. A. S. C. LAWRENCE was granted a Beilby Memorial award of 150 guineas for research work in colloid science. MR. KENNETH HALL was appointed president of the Council of the Aluminium Development Association. MR. R. L. TAYLOR was elected chairman of the Association of British Pharmaceutical Industry. PROF. J. T. RANDALL, DR. H. A. H. BOOT and PROF. J. SAYERS shared £36,000, presented by the Royal Commission on Awards for wartime research on radar.

Obituary: Sir Robert Robertson, Prof. F. S. Kipping, Mr. R. G. Perry, Mr. John W. Hawley, Mr. Douglas J. Davis, Viscount Leverhulme.

JUNE

THE adoption by Great Britain, the U.S.A. and Canada of the new "unified" screw thread was announced.

I.C.I., Ltd., received Dean of Guild approval to extend its Grangemouth dyestuffs factory at a cost of £131,000.

An extensive new seam of coal, nearly 6 ft. thick, supplementing the discoveries near Lichfield and Brereton, was located at a depth of 27,000 ft. during the sinking of a new shaft at Clipstone Colliery, Mansfield, Notts. The mineral wealth of the seam was described as almost limitless.

An official British announcement issued from Düsseldorf stated that dismantling was to begin on June 8 at the four Fischer-Tropsch synthetic oil and chemical works in Wanne-Eickel, Dortmund, Castrop-Rauxel, and Bergkamen. In all, six Fischer-Tropsch, three Bergius, and two artificial rubber plants were scheduled for dismantling under the terms of the Washington Agreement.

A project estimated to cost £37.5 million began at Fawley, Southampton, for the construction of the Anglo-American Oil Company's new oil refinery, which it was claimed would be the largest in Europe.

The increased importance of chlorine dioxide in recent years, in its capacity as an energetic oxidising agent, lent interest to two new methods of production which were the subject of English patents recently opened to public inspection.

A grant of $20,000 to the University of Saskatchewan for plant food research, using radioactive tracer techniques, was made by the Consolidated Mining and Smelting Co. of Canada, Ltd.

New laboratories were opened at the West Bank Works, Widnes, of W. J. Bush & Co., Ltd. The new building comprised both research and works departments.

An agreement between Compagnie Française de Raffinage and the Standard Française des Pétroles provided for technical and commercial co-operation between these two leading French oil refining companies.

A 12-man research institute was being set up by the Government of Israel to serve as the highest authority in the State for the co-ordination of research and the advancement of science.

A factory four miles north of Saldanha Bay, South Africa, designed to produce £500,000 worth of magnesium and other salts and metals from sea water annually, started production on June 1.

A discovery capable of doubling South Africa's available imported creosote supplies (from 250,000 to 500,000 gal. a year) was announced by the Forest Products Institute in Pretoria. The discovery was principally a "bridging agent" permitting the mixture of certain mineral fuel oils with creosote.

The laboratories of the Research Council of the British Whiting Federation were established at Bedford, for the study of the properties and uses of whiting and other forms of processed chalk.

The belief in Great Britain's continued eminence in scientific research was testified by the endowment and establishment of a new Ciba Foundation at 41 Portland Place, London, W.1.

The successful operation at their Hull works of new plant for large-scale production by the Bisol process of acetoacetanilide for the dyestuffs industry was reported by British Industrial Solvents, Ltd.

Chance Bros., Ltd., Smethwick, Birmingham, announced the production of a new ophthalmic glass, to replace a former type which has been banned for commercial purposes by the Government owing to the strategic value of uranium, a small proportion of which was used in its composition.

Personal: PROF. H. P. HIMSWORTH was appointed secretary of the Medical Research Council, from October 1. Order of Merit was conferred on SIR ROBERT ROBINSON. DR. C. F. FLINT was appointed head of the National College of Rubber Technology. MR. ALLAN DRAPER was elected chairman of the Textile Institute for next 12 months.

Obituary: Mr. J. P. MacKinnon, Dr. James D. Ogilvie, Mr. Sidney Abbey, Mr. Charles A. Buckmaster, Mr. John M'Gougan, Prof. Edmund J. Garwood, Mr. James A. Macarthur, Dr. Herbert W. Bolam, Mr. Robert E. Gale, Mr. Charles Day.

JULY

THE CHEMICAL AGE started its 61st volume and No. 1564 in a new guise with new type faces and bolder style headings.

Some details of Harwell's "hot" laboratory for separating fission products were revealed by the Ministry of Supply.

Need for some form of international regulation was urged by the International Tin Study Group at its meeting in London.

Fuller Colonial research was made possible by the new Colonial Development and Welfare Act (1949) under which the annual amounts payable were increased to £2½ million.

Names of the chairman (Sir Percy Mills) and members of the National Research Development Corporation and its powers to exploit inventions to the benefit of the community were announced.

Fourth Empire Mining and Metallurgical Congress was held in London, with technical sessions at Oxford and excursions round Cardiff, Cornwall, Edinburgh and Newcastle-on-Tyne.

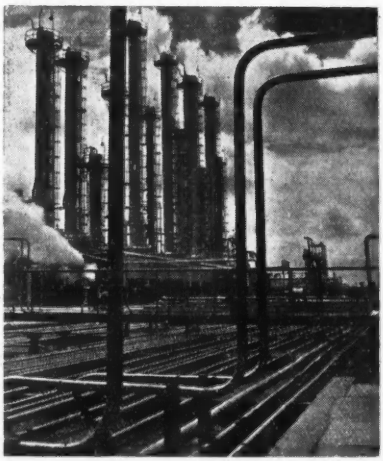
The work of the Chemical Research Laboratory, Teddington, was shown to scientists and the Press, revealing useful advances in metal protection and insecticides.

Improved methods of isolating thorium were claimed in the U.S.A. at the second annual Analytical Symposium of the American Chemical Society.

Two new synthetic fibres, one derived from cottonseed protein, the other from chemically modified cellulose, were produced experimentally at a U.S. Bureau of Agriculture and Industrial Chemistry's research laboratory in New Orleans.

Laporte Chemicals, Ltd., in its 42nd annual report, showed a group profit of £583,336.

Numbers of persons employed in the chemical and allied trades totalled 435.1 thousand, a slight increase over the previous month.



[Shell Photographic Unit

The magnitude of the engineering task was revealed on the eve of the opening of the Shell petroleum chemicals plant at Stanlow, of which this distillation unit forms a part

The end of bulk purchase and return to conditions of a free market were advocated at the annual general meeting of the British Non-Ferrous Metals Federation.

Steel output for July reached an annual rate of 12.695 million tons compared with 12.084 million tons in the same month of 1948.

Improvement in the stock position of basic chemicals in July continued. Production figures generally reflected a small increase, but there was little change in the level of consumption.

An anti-trust suit was filed by the U.S. Attorney-General in Chicago on behalf of the Department of Justice in an attempt to break up the $1588 million organisation of E. I. du Pont de Nemours and Co., Inc., the largest chemical producers in the U.S.A.

Chemical manufacturers in the Anglo-U.S. zone of Germany demanded that German experts and trade associations should be allowed to participate in commercial negotiations with foreign countries.

Claims from Ceylon stated that novel methods had been evolved to use rubber for the production of wood preservatives, insecticides, varnishes, etc.

The first large-scale plant in Great Britain for the production of Alkathene film in continuous rolls up to 46 in. wide came into operation.

The project was announced to spend $10 million on developing newly discovered asbestos deposits near Larder Lake, North-West of Ontario, Canada.

Modern plant for production of pharmaceutical chemicals was opened at Verona, Italy, by Glaxo Laboratories, Ltd.

Methoxychlor, the methoxy analogue of DDT, reached the pilot plant scale stage of development in the U.S.A.

Conophor oil was produced at Liverpool University from the seed of a West African wild vine *tetracarpidium conorphorum* as a potential substitute for linseed oil.

Attempts to tap the first potash deposits in England were reviewed in a report issued by the Mineral Development Committee, which recommended development by the State of all such minerals.

Chemical exports from the United Kingdom in July totalled £6,434,589, compared

with £6,947,307 in the previous month and £7,580,839 in July 1948.

Personal: Prof. E. C. Bullard, professor of physics, University of Toronto, was appointed director of the National Physical Laboratory, Teddington, in succession to Sir Charles Darwin.

The Croonian Lecture for 1949 at the Royal Society, London, was delivered by Dr. W. Bronk, foreign secretary of the National Academy of Sciences and chairman of the National Research Council of the U.S.A.

Prof. James W. McBain, professor of chemistry at the U.S. Stanford University, was appointed director of the National Chemical Laboratory, Poona.

Prof. O. V. S. Bulleid was elected president of the Institute of Welding for 1949/50.

Sir Graham Cunningham, chairman of Triplex Glass, Ltd., and Quickfit and Quartz, Ltd., was appointed first chairman of the Dollars Exports Board.

Dr. H. W. B. Skinner, former deputy chief scientific officer in charge of the general physics division at the AERE, Harwell, was appointed to the Lyon Jones chair of physics at Liverpool University.

Obituary: Prof. Otto Liebknecht, Mr. William D. Penly, Mr. Samuel Renton, Mr. Frank van Zwanenberg, Prof. Otto Czadek, Mr. Harry Collinson, Mr. Charles Brotherton.

AUGUST

PROPOSALS to manufacture carbon black at Avonmouth were described at the annual meeting of Philblack, Ltd. The plant was designed to produce 50 million lb. of carbon black a year by a U.S. process.

Further research developments on substitutes for linseed oil were described by the Colonial Products Research Council.

Increased standardisation as an aid to greater productivity was recommended by Lord McGowan, president, at the 48th annual general meeting of the British Standards Institution.

A project was announced to revive the sulphur mining industry in Sicily.

Israeli's first major optical lens grinding plant began operations in Haifa.

First International Congress of Biochemistry was held at Cambridge.

The number of deaths from industrial accidents in the U.K. in August was 137, a decrease of six from the previous month, but 29 more than in August, 1948.

Production and consumption levels of basic chemicals in the U.K. in August showed an increase over the same month of 1948. The price of lead rose to £87 5s. a ton.

Expansion schemes costing £40 million were disclosed by Lord McGowan, chairman of Imperial Chemical Industries, Ltd., on his visit to the Dyestuffs Division, Grangemouth, Stirlingshire.

The second stage in a development scheme for steel and ore grading plants involving a further £8 million expenditure was announced by Dorman Long & Co., Ltd.

Problems concerning the emission of toxic fumes or gases and pollution of the atmosphere were reviewed in the 85th Annual "Report on Alkali, etc., Works," for 1948.

A new liquid oxygen converter was reported to have been developed by the U.S. National Bureau of Standards.

Eleven of America's largest alkali producing companies, all members of the U.S. Alkali Export Association, were ruled to have violated the Sherman Anti-Trust Act by the decision of U.S. Federal Judge, Samuel I. Kaufman.

The first continuous shale-oil refinery in the U.S.A. was put on stream by the U.S. Bureau of Mines, near Rifle, Colorado.

Steel output for August reached an annual rate of 14.953 million tons, compared with 14.117 million tons in the same month of 1948.

Chemical exports for the month showed a general decrease compared with August 1948, the total value being £6,594,864, against £7,021,087.

Personal: DR. F. J. WILKINS, of Glaxo Laboratories, Ltd., was appointed executive director at Ulverston and Barnard Castle. The Ministry of Supply appointed MR. J. G. BALL, of the BWRA, to be principal scientific officer at the Atomic Energy Research Station, Harwell. MR. H. M. GARNER was appointed chief scientist of the Ministry of Supply.

At the newly founded New South Wales University of Technology: DR. J. P. BAXTER appointed to the chair of Chemical engineering; DR. A. E. ALEXANDER, to the chair of applied chemistry. DR. H. N. RYDON was appointed reader in organic chemistry in the Imperial College of Science and Technology. Honorary

degrees conferred at Cambridge on, among others, PROF. ARNE TISELIUS, at the first International Congress of Biochemistry. DR. I. M. RABINOWITCH, of Montreal Hospital, was awarded $10,000 by the Sugar Research Foundation, Inc., to continue his work on carbohydrate metabolism. DR. IRVING M. KLOTZ was awarded the $1000 Eli Lilly & Company prize for biological chemistry at a meeting in September of the American Chemical Society.

Obituary: Mr. W. H. French, Dr. Fritz J. Hansgirg, Mr. John Stewart Macarthur.

SEPTEMBER

THE adoption of a standardised screw thread was recommended by delegates of 15 nations at the meeting in Paris of the International Standardisation Organisation.

The British Association for the Advancement of Science held its 111th annual meeting at Newcastle-on-Tyne.

A further stage in the development by Imperial Chemical Industries, Ltd., of its £22 million project was marked by a visit of specialists and members of the Press to the big group of chemical installations at Wilton.

The widening range of industrial chemistry and engineering in the North was demonstrated at the Scottish Industries Exhibition, Glasgow.

The development of Canada's chemical industries and their prospects of greater Canadian oil production were discussed at the regional conference of the American Institute of Chemical Engineers, held in Montreal.

Sir John Simonsen, director of the Colonial Products Research Council of the Colonial Office, received the Fritzsche Award for research on essential oils at the 116th national meeting of the American Chemical Society.

Chrome pigments were exempted from export licensing.

Chemical processing plant of many kinds was prominent at the Engineering and Marine Exhibition, at Olympia, London.

The intention was announced to establish the first rubber factory in Ceylon. One-fifth of the Rs.5 million capital will be foreign, chiefly American.

Rapid progress was reported in the construction of the £37.5 million Esso refinery at Fawley, near Southampton.

New German patent legislation was agreed to by Anglo-American authorities.

The report on India's plastics industry showed great increase in production of finished goods and emphasised the need for a central factory to manufacture moulding powders.

Chemical exports for September were valued at £6,994,535 compared with £7,519,213 in the same month of the previous year. The first nine months of 1949 totalled £64,546,670, which represented an increase of £2,344,959 over the same period of 1948.

Personal: SIR HAROLD HARTLEY was appointed president of the British Association for the Advancement of Science, for 1950. DR. IAN CLUNES ROSS was appointed chairman of the (Australian) CSIR.

For his book, "An Entry to Organic Chemistry," PROF. JOHN READ, University of St. Andrews, awarded £500 prize by the city of Cortina d'Ampezzo and the Italian review, *Ulisse*. American Chemical Society honours included: DR. G. E. F. LUNDELL, the $1000 Fischer award in analytical chemistry; DR. ARTHUR B. LAMB, retiring editor of the *Journal of the American Chemical Society*, received the Priestley Medal; DR. BRUCE H. SAGE, the $1000 Precision Scientific Company award in petroleum chemistry; DR. RICHARD T. ARNOLD, the $1000 ACS award in pure chemistry.

SIR ALFRED EGERTON received an honorary degree at Helsinki of the Finnish Institute of Technology. DR. A. J. GUINIER was awarded the 1949 Charles Vernon Boys prize of the Physical Society. DR. WILLIAM F. HESTER named administrator of the fellowships of Koppers Company, Inc., at Mellon Institute. The National Smoke Abatement Society appointed as its new president, DAME VERA LAUGHTON MATHEWS.

Obituary: Mr. E. T. Stannard, Mr. R. J. Parker, Mr. Arthur D. Storke.

OCTOBER

THE completion of one of the most elaborate surveys yet produced was announced by the Association of British Chemical Manufacturers, "a comprehensive Survey of Chemical Industry." This was compiled in compliance with a request by the President of the Board of Trade,

from numerous questionnaires circulated throughout various sections of the industry and imposed a heavy task of classification and discrimination. Many undertakings commonly regarded as part of chemical industry were not included. The report, which was intended to reflect chemical industries' plans for research and production development for five years, has not been published.

A gift by Imperial Chemical Industries, Ltd., of £12,000 for research fellowships in chemistry, physics and biology at Pakistan universities was accepted by the Pakistan Association for the Cultivation of Science.

Proposals to extend the list of noxious or offensive gases mentioned in the Alkali, etc., Works Act 1906, were made in a draft order prepared by the Ministry of Health. Individual objections were raised to the inclusion of carbon black works.

The second stage of its development scheme, involving expenditure of £8 million, was announced by Dorman Long & Co., Ltd., as being put in hand immediately.

Prospecting at Halkyn, Flintshire, was expected to lead to the opening up of lead deposits.

Problems of locating, mining and processing radioactive ores were discussed at a technical conference in London of atomic experts representing Great Britain, Canada and the U.S.A.

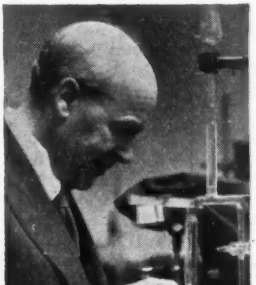
Names were announced of the first eight of 50 British scientists and technologists who will receive advanced technological training and practical instruction in American production methods under the technical assistance programme of the Economic Co-Operation Administration.

Formal recognition given to new names for a number of elements at the International Union of Chemistry in Amsterdam was reported at the 116th International meeting of the American Chemical Society.

Chemicals, oils, gums and resins were among the wide range of goods released from import licensing restrictions announced in the House of Commons by the President of the Board of Trade.

New materials and techniques were demonstrated at the first Packaging Exhibition, opened by Sir Robert Sinclair at the City Hall, Deansgate, Manchester.

Report on the ammonium nitrate explosions which resulted in the Texas City disaster on April 16, 1947, issued by the U.S. Department of the Interior, Bureau of Mines, Washington.



Prof. E. N. da C. Andrade, F.R.S., was named as the next director (in 1950) of the Royal Institution and of the Davy-Faraday Research Laboratory, succeeding Prof. E. K. Rideal

International Union of Leather Trades' Chemists held its first congress in Paris.

Chemical risks and safeguards were discussed at Scarborough at the second conference organised on behalf of the Association of British Chemical Manufacturers by the Royal Society for the Prevention of Accidents.

New chemical laboratories of Doulton & Co., Ltd., were opened at Tamworth, Staffordshire.

A new explosive—Unibel—for use in coal mining was introduced by Imperial Chemical Industries, Ltd.

A new section of the Royal Institute of Chemistry was formed in Dundee to serve the city, and the counties of Angus, Perth and Fife.

A big improvement in exports was recorded at the 25th annual meeting in London of the British Sulphate of Copper Association.

Eight new Fellows and 37 Associates were successful in the RIC September examinations.

Chemical exports in October showed an increase in value when compared with both September and the corresponding month of 1948. Total figure amounted to £7,640,808 an increase of £470,082 over October, 1948.

Exports of chemicals from the U.S.A. for the first half of 1949 reached the record total value of $449,549,510.

Steel production in October was at a new high level, the output of ingots and castings reaching an annual rate of 15,959,000 tons, 53,000 tons more than the previous month.

The Lord President of the Council appointed MR. A. H. WILSON, MR. A. H. S. HINCHCLIFFE, LORD HALSBURY and PROF. R. S. EDWARDS members for five years of the Advisory Council for Scientific Research.

LORD BOYD-ORR was named as the recipient of the Nobel Peace Prize for 1949.

New directors: MR. P. D. O'BRIEN and MR. B. E. A. VIGERS assistant managing directors of Laporte Chemicals, Ltd.; MR. ARTHUR COCHRANE chairman of H. J. Elliott, Ltd.

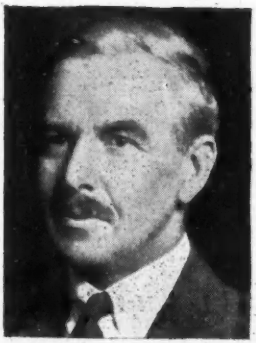
Obituary: Mr. Stanley Kiver, Dr. Arthur Pillans Laurie, Mr. A. B. Allison, Mr. Alexander O'Beirne, Prof. Thomas S. Price, Dr. J. A. Schedler.

NOVEMBER

CLAIMED to be the largest catalytic oil cracking unit in the world, the new 41,000-barrels-a-day plant of the Esso Standard Oil Company was formally dedicated at Linden, New Jersey.

Financial aid to purchase machinery costing $9 million for the petroleum chemicals plant at Grangemouth, Scotland (the Anglo-Iranian Oil Company and the Distillers Co., Ltd.) was approved by ECA.

The Nobel prize for chemistry was awarded to Prof. W. F. Giaque, professor of chemistry at the University of California and for physics to Dr. Hideki Yakawa, a Japanese scientist who has been visiting professor of theoretical physics at Columbia University, New York, since September 1949.



Royal Medallist: Prof. R. A. Peters

A grant of $4.1 million was agreed by the ECA to finance modernisation and expansion plans of the French oil industry.

An apparatus claimed to be capable of producing radioactive isotopes in a simple manner was demonstrated by the A.S.P. Chemical Co. at Gerrards Cross. The Aspatron was said to make a more effective use of the gamma-neutron exchange process.

A range of commodities from which quantitative restrictions have been removed, in accordance with the OEEC decisions, was disclosed by the West German Minister of Economic Affairs.

The work of the chemist and metallurgist in helping to produce new or better materials and equipment for industrial and domestic building was represented at the 23rd Building Exhibition, at Olympia, London.

The closing of its tar distillation plant at Sunderland, because of the expiration of the lease and uneconomic conditions of the site, was announced by Monsanto Chemicals, Ltd.

A new record of production of steel ingots and castings was set up in November—an annual rate of 16.358 million tons, compared with 15.959 million tons the previous month, and 15.76 million tons in November 1948. This was only slightly lower than the peak figure established in May.

Chemical exports in November showed a decrease in value compared with both October and the same month of 1948. Total value amounted to £6,893,694 compared with £6,961,717 in the same month of 1948.

The Royal Society awarded the Royal Medal to PROF. R. A. PETERS, and the Davy Medal to PROF. A. R. TODD. The Perkin Medal was awarded to MR. E. V. MURPHREE, president of the Standard Oil Development Co., New York, by the American section of the Society of Chemical Industry. Research scholarship in the application of light alloy to ship construction was awarded by the Aluminium Development Association to MR. J. B. CALDWELL.

Obituary: Mr. S. R. Guggenheim, Mr. George Moores, Mr. A. J. Chapman, Mr. J. P. D. Coleman, Mr. J. R. Hobbins.

DECEMBER

THE start of the first underground gasification project at Newton Spinney, near Chesterfield, was announced by the NCB.

The cessation of dismantling on 11 synthetic rubber and oil plants in Western Germany was announced by the High Commission.

ECA final approval announced of advance of the reduced sum of $6.5 million for the purchase of U.S. equipment for the petroleum chemicals plant of the Anglo-Iranian and Distiller companies at Grangemouth, Scotland.

The large crude oil refinery at Stanlow, Cheshire, was put into operation a month ahead of schedule. The Shell Petroleum Co. estimated that the refinery would deal initially with one million tons of crude oil a year.

The first full trial of the frequency modulated cyclotron was carried out successfully at Harwell, Berks. Work was suspended on the construction of the atomic pile project at Sellafield, Cumberland.

A new institute for seaweed research, headed by Prof. Henrik Printz, was founded by the Royal Norwegian Council for Scientific and Industrial Research.

The first quantity production of hydrazine hydrate was announced by British manufacturers.

Dr. H. Levinstein was re-elected president of the British Association of Chemists.

A concentrate of vitamin B_{12} obtained from deep-fermentation of the mould *Streptomyces*, was marketed by Glaxo Laboratories, Ltd.

Changes with far reaching effects on the safeguards which industries and other interests would be obliged to take to minimise the discharge of noxious material into streams and rivers were outlined in the report of the Rivers Pollution Subcommittee of the Central Advisory Water Committee.

Surveys of supply and demand for chemists and physicists in Government service, industry, research and teaching, showing the need of greatly increased numbers over the next five years, were published by the Ministry of Labour and National Service.

The removal of import restrictions on a further wide range of chemical and other goods was announced by European Governments in accordance with the agreement with the OEEC for the liberalisation of European trade.

The Board of Trade announced that the Token Import Scheme would be continued in 1950 on the same basis as 1949.

Allegations that the North British Aluminium Co. was not fulfilling its obligation rapidly to prevent fluoride emission were made at the Court of Session, Edinburgh, when proceedings were resumed on claims that noxious fumes from the company's plant were causing harm to animal and vegetable life.

Expansion of its British overseas plants to produce flat glass was announced by Pilkington Brothers. One new factory, estimated to cost $3 million, near Toronto, and another in South Africa, are expected to be in production by 1951.

American advances in new chemicals, in chemical processing and methods of evaluation were demonstrated at the 22nd Exposition of Chemical Industries in New York.

World consumption of fertiliser nitrogen in 1948/49 reached the record figure of about 3.5 million metric tons, according to the 29th annual report of the British Sulphate of Ammonia Federation.

Vermiculite, compounded with sand and Ciment fondu, was used by a Wolverhampton firm to produce a new grooved insulating brick.

A new technique employing radioactive tracer gas for the accurate location of leaks in pneumatic systems was notified by the British Thomson-Houston Co., Ltd., Rugby.

The new chemistry department at King's College, Newcastle-on-Tyne, was opened by Sir Robert Robinson.

Hazards of fire and explosion were the cause of many accidents in 1948. Gases accounted for 412, liquids 478, and solids and dusts 484, according to the annual report of the Chief Inspector of Factories.

India's requirements of chemicals and fertilisers were reviewed in a survey made by Mr. Rowland Owen (senior U.K. trade commissioner) published by HMSO. Important raw materials for her chemical industry had been lost to India by the separation from Pakistan.

SIR GRAHAM CUNNINGHAM resigned the chairmanship of the Dollar Exports Board. PROF. DAVID CAMPBELL was elected president of the General Medical Council.

Obituary: Lady Mond, Mr. Elias Goldberg, Mr. Bernard R. Armour, Mr. Alexander R. Anderson, Mr. T. P. Ward, Mr. Peter Irvine, Prof. Hubert Kappen, Mr. Evan C. Evans.

PROGRESS IN POLYMER PRODUCTION

Few New Plastics Introduced in 1949

by PAUL I. SMITH

DURING 1949 relatively few new plastics were introduced but notable progress was made in the production of known polymers in more marketable forms, and also in the improvement of fabricating methods and the development of new applications for both thermosetting and thermoplastic resins.

Fluorinated plastics now comprise several materials: polytetrafluoroethylene or PTFE, polyvinyl fluoride or PVF and polymonochlorotrifluoroethylene or KEL-F. In Great Britain only PTFE is available in commercial quantities.

The starting material is difluoromonochloromethane, $CHClF_2$ (Freon gas), which is prepared by the reaction of chloroform with anhydrous hydrofluoric acid. The gas, which boils at −40.8°C. is passed through a pyrolysis tube of inert material, preferably platinum, at temperatures in the range of 600-800°C. when monomeric tetrafluoroethylene, C_2F_4, and hydrochloric acid are formed. The monomer, after purification, is polymerised in a stainless steel autoclave containing an aqueous solution of ammonium persulphate or other peroxy catalyst. The polymer $(C_2F_4)_n$ is a granular white solid.

Uses for PTFE

Principal uses so far found for PTFE are in the electrical and chemical fields; in the latter its application as a packing for nitric acid plants, petroleum refining processes, etc., is assuming growing importance. PTFE rings are now being made containing no lubricant and also impregnated with graphite throughout the fibrous structure. These packings are not affected by any solvent acid mixtures, acids or caustic solutions at temperatures up to 690°F. It is claimed that their non-adhesive properties prevent excessive wear of reciprocating rods, shafts and valve stems.

Polyvinyl fluoride can be made by injecting 100 parts of vinyl fluoride containing traces of acetylene and oxygen into a silver-lined reaction vessel containing 120 parts of deoxygenated water and 80 parts of pure methanol and 0.2 parts of benzoyl peroxide. Heating and agitation followed by introduction of fresh vinyl fluoride brings about polymerisation.

So far no great progress seems to have been made with polyvinyl fluoride and experiments have been handicapped by its explosive nature when subject to temperatures in the region of 250°C.

KEL-F has all the appearance of being a most useful addition to the range of fluorinated plastics. It is slightly inferior in chemical resistance, thermal properties and electrical insulation to PTFE but has the advantage of being easier to fabricate on conventional machines. Increasing interest is being taken in polyethylenimine, which was produced in Germany prior to 1944 by I.G. Farben at Ludwigshafen.

Paper Pulp Treatment

Investigation has shown that this polymer is of outstanding value for the treatment of paper pulp for making handkerchiefs, cleaning tissues, shoe insoles, gaskets and all types of absorbent papers, anchor coatings for regenerated cellulose film, waterproofing textile materials and as a hydrophobising agent for rayon and as a cross linking agent for wool.

One process for making the monomer involves the reaction of monoethanolamine with sulphuric acid to produce beta-aminoethyl hydroxide to yield ethylenimine. This monomeric gas is very inflammable, can polymerise with explosive violence and is highly toxic. At the Ludwigshafen plant the monomer was polymerised as it distilled from the preparation kettle and in this way the handling of the monomer was avoided.

One of the most interesting of the newer forms of familiar plastics is an alkyd moulding compound which was first introduced in 1948 but was not employed to any great extent until 1949. This resin possesses a phenomenally high arc resistance and tracking will not occur.

The high heat resistance—ASTM tests show its heat distortion point to be between 350° and 400°F.—excellent dimensional stability when exposed to dry or very humid conditions of use and very low moisture resistance and indifference to all organic solvents and dilute acids, make this new moulding compound of exceptional interest to the electrical trades and the chemical and engineering industries.

Alkyd resin is the fastest curing moulding material commercially available. When it is heated in the moulds for a period of two seconds it becomes very plastic, nearly attaining a fluid state. It can, therefore, be moulded at lower pressures (500 to 900 p.s.i.) than conventional materials. As no gases are given off during moulding, alkyd compounds are particularly suitable for automatic moulding procedure.

Alkyd Mouldings

To the moulding industry alkyd is very attractive as instead of the massive highly expensive hydraulic presses necessary for phenolic and urea powders, a small, inexpensive air-operated press can be used with alkyd to give equally good results.

A revival of interest in the polyester resins, such as alkyd diallyl phthalate polyester, which are used with glass fibres for the production of a wide range of reinforced mouldings, occurred during the year. Some of these are produced at pressures as high as 1000 p.s.i., at low pressures of 50 p.s.i. and at no pressure.

Fibre glass reinforced plastics have been used for all manner of products ranging from small parts of electric wiring devices to casting rods and fly rods for the angler, aircraft structural parts and up to the hulls of motor boats of considerable size. Using fibre glass plastics, articles having strength-weight ratios in excess of those of any known material including stainless steel aluminium and magnesium can be obtained. Moreover, these possess an impact resistance greater than that of most metals either in strength-weight or equal thickness basis.

The manufacture of fibre-glass reinforced plastics is simple. The fluid resins are combined with the reinforcing fabric or mat on the inside or on the surface of a mould made of low cost, easily washed materials. In some cases, the prepared mould is enclosed in a bag-like envelope from which the air is exhausted to apply atmospheric pressures that hold the uncured, reinforced resin snugly to the mould. The whole unit is then placed in an oven at a moderate temperature and in a relatively short time a completed product is ready for removal from the mould for trimming and finishing.

Notable progress has been made in America with styrene-butadiene polymers and also co-polymers of styrene and isobutylene. The first named are horny substances which need compounding with rubber to produce compositions possessing great toughness, high impact strength and heat resistance. Applications so far found for these new plastic-rubber mixes include shoe-soles, floor coverings, golf ball covers, shipping containers and carrying cases.

The styrene-isobutylene plastics are characterised by rubber-like elastic properties and low permeability to moisture and gases. They are therefore calendered to form film for the packaging of foodstuffs, particularly fruit and other commodities where moisture needs to be retained but transmission of oxygen and carbon dioxide can take place. Acrylonitrile polymers can be used in combination with butadiene-acrylonitrile rubbers for the production of tough plastics.

Interesting elastomeric co-polymers are now being produced from vinylidene chloride and butadiene using a low butadiene content and a high percentage of vinylidene. These are similar in some respects to the styrene-butadiene but possess greater toughness and superior ageing properties.

A notable increase in the use of furfural and its derivatives in resin making has taken place during the last two years. Interest now is not so much centred on direct aldehyde condensations but the formation of high polymers through ether linkages; methylene bridging from furfuryl alcohol reaction and addition polymerisation through conjugated furan ring.

It is considered that the Diels-Alder addition products offer great potentialities and may make possible the setting or cross linking of the furfuryl alcohol polymers to form low pressure laminating resins and more flexible type phenol aldehyde resins.

Electrical Properties

Polyvinyl carbazole is a new thermoplastic similar in some respects to polystyrene but possessing superior thermal properties; it has a heat distortion point of up to 150°C., compared with about 80°C. for polystyrene. The electrical properties of this new resin are of exceptional interest where a very low power factor is required.

The monomer, which melts at 70°C., can be used for the impregnation of electrical components and may be polymerised by heat treatment. Compression or injection moulding can be carried out with equal success. At high temperatures the polymer can be stretched to form a highly fibrous asbestos-like material which may be used as a reinforcing filler for moulding ordinary polyvinyl carbazole. Such mouldings can be accurately machined.

Polystyrene is now being produced possessing improved light stability, greater toughness and heat resistance. By control of molecular chain forms in the

polymer it is possible to produce greatly improved material. The ASTM heat distortion temperature of one grade of modified polystyrene is 192°F. (89°C.) which is considerably higher than unmodified polymer; properly moulded parts have a maximum service temperature of 180°F. (82°C.). Mouldings of modified styrene have outstanding weathering characteristics and stand up under continuous outdoor exposure, in all kinds of weather, without crazing or warping.

A new resinous hydrocarbon is now being produced by the catalytic condensation of specific alkyl naphthalenes followed by purification and high vacuum distillation. The various grades of this new polymer have tackiness, non-volatility and electrical properties comparable with polybutenes, but are opposite in viscosity index and solvent power. This new plastic is recommended for vinyl insulated wire, cable filling, rigid vinyl mouldings, adhesives and sealing compounds, vinyl floor tiles and composition rollers.

One grade of nylon moulding powder is now being produced in Great Britain for the injection moulding of small engineering parts, particularly nuts, cams and bearings which require no lubrication.

Nylon Machinery Bearings

In the textile industry oil has long been a problem in the making of yarn. During spinning, the yarn is drawn through rollers that stretch and align the fibres. The parts that keep the rollers weighted and in place are called "saddles" and "cap bars." The bearing surfaces of these require frequent time-consuming oiling. An average mill may have as many as 135,000 such places to oil as often as once a day. Frequently, oil gets on the rollers and is transferred to the yarn necessitating costly cleaning and, in addition, the oily rollers pick up lint that must be removed by hand. When the oil supply on the bearings gets low, the rollers slow down and cause uneven spinning.

Nylon bearings eliminate oiling, reduce yarn damage, help maintain uniform yarn quality, end roll-picking and reduce average power consumption. Another interesting use for nylon mouldings is found in the chemical industry where nylon valve seats for gas containers holding hydrogen, propane, carbon dioxide or compressed air are able to stand up to service conditions for much longer periods than the more usual valve materials; they are now softened by lubricants and able to withstand high compression temperatures.

Until 1949 nylon was only available in the natural cream colour, but during last year Du Pont offered polymers in a range of 16 attractive colours. These are not affected by moulding temperatures and articles moulded of the coloured grades have the same resistance to heat as do items of the natural material. Coloured nylon mouldings can be sterilised by steam.

Melamine Resins

Experience with melamine has shown it to be an extremely valuable thermosetting resin. Melamine plastics are now being produced in various forms: alpha-cellulose-filled melamine formaldehyde moulding compounds; chopped, cotton-cloth-filled, melamine formaldehyde material; mineral filled melamine formaldehyde moulding compound; unfilled melamine formaldehyde resin and chopped cotton-cloth filled, phenol-melamine formaldehyde thermosetting moulding compound.

All these melamine plastics form odourless, tasteless and chemically inert moulding compounds which possess exceptional mechanical and electrical properties. The alpha-cellulose-filled resin is particularly useful for buttons, lighting fixtures and reflectors; the mineral-filled melamine for aircraft, automobile and tractor ignition parts, circuit breakers, terminal blocks and electric insulating applications: the chopped cotton-fabric-filled melamine is excellent for uses requiring resistance to shock, *e.g.*, food trap, circuit breakers, insulation on electric motors, mining machinery and tableware.

Cellulose acetate butyrate is becoming of greater importance than cellulose acetate on account of its superior dimensional stability, or resistance to distortion under varying conditions of temperature and humidity.

This is due in part to the less hygroscopic nature of the mixed ester and to the fact that it requires much less plasticiser to obtain a given degree of flow. It is also possible with the acetate butyrate to use plasticisers that have higher boiling points, lower vapour pressures and greater compatability with the ester than those suitable for use with cellulose acetate. Moulding compounds based on the mixed ester require less pressure for moulding or extrusion than does cellulose acetate of the same flow.

Several additions have been made to the already extensive range of synthetic resins based on rosin and used mostly in the coating field. Of these the most important to-day are the pentaerythritol esters of rosin, the heat sealing alkyd resins based on resinous terpene polybasic acid and the

ethylene glycol esters of polymerised and hydrogenated rosin.

These are all used in various ways in the formulation of lacquers, varnishes and adhesives, *e.g.*, hydrogenated rosin-modified alkyd resin is used as the hard resin component in interior nitrocellulose lacquers and in cold-check-resistant furniture lacquers. One firm specialising in resins made from rosin produces twelve complete families of terpene resins, the simplest being the methyl ester of a rosin which is employed as plasticiser, as a plasticising co-solvent, and as a resin extender and modifier.

Polyacrylonitrile Fibre

The new Du Pont polyacrylonitrile fibre was made available in commercial quantities during 1949. It is spun in a similar way to cellulose acetate. Solvents used are dimethyl formamide, dimethyl methozyacetamide, tetramethylene sulphone and *m*- and *p*-nitrophenols. Resistance of the fibre to outdoor exposure is good but nylon has greater resistance to abrasion and alkalis.

Film is characterised by its warmth and bulking properties which are caused by its irregular " dog-bone " cross section, while its bark-like striated surface accounts for surface wettability and adhesion to resins and rubbers. Owing to the high resistance of polyacrylonitrile fibre to microbiological attack it is likely to find many applications in tropical climates.

Another new synthetic fibre " Vinyon-N " or vinyl chloride-acrylonitrile fibres possesses excellent resistance to mildew, ability to withstand hot ironing, good light stability and excellent ageing properties. Spun " Vinyon-N " yarn is stretched 900 or 1300 per cent at about 120°C. in steam, when the tenacity is raised to 4 g. per denier.

Polystyrene monofilaments were produced in the U.S.A. during 1949. To date, brushes made of these monofils have been commercially used in whisk brooms and floor brooms where the electrostatic quality of the material helps the brush pick up dust and lint.

Vinyl monofils ranging from 0.008 to 0.022 in. are being added to the list of tufting materials. Main disadvantages are low service temperature and readiness to fray above 140°F.

Unplasticised polyvinyl chloride yarn is now being produced in France for use in making cloth for filters, tissues in orthopædics, for upholstering, in the form of ropes, belts, strings and packings. The yarn has excellent physical properties and possesses good resistance to acids, alkalis and other corrosive agents. The cloth woven from PVC fibres is non-inflammable; in fact it shrinks away from the flame as the source of heat approaches.

Filter cloth made from unplasticised PVC is unaffected by aqua regia, caustic potash solution (50 per cent), caustic soda (36 per cent), concentrated sodium hypochlorite solution and concentrated nitric acid. Organic solvents such as ethyl alcohol, ethyl ether, carbon tetrachloride and amyl acetate have no injurious effect. The cloth is specially suitable for filtering gases and the filtration of extremely fine particles.

The esters of fatty acids are being used to an increasing extent as non-migrating plasticisers for the vinyls; in particular the recinoleates, stearates, oleates and azelates are of importance. The 2-ethyl hexyl ester of azelaic acid has a number of outstanding properties which make it an ideal primary plasticiser. Among these are low volatility and high water resistance and ability to impart low temperature flexibility to films which are clear, free from haze and possess excellent tear strength.

The 2-ethyl butyl ester of azelaic acid is also used for vinyl sheets and film. Both these esters are preferable to the better known dioctyl azelate which has the disadvantage of being highly extractable from stocks by oil and water.

Flexibility

Solvent type plasticisers, such as the diethylene glycol ester of pelargonic acid, combine high degree of flexibility over a wide temperature range and exceptional performance at low temperatures. Films possess high tensile strength and good elongation.

Another new plasticiser is tetrahydrofurfuryl oleate which shows excellent light and heat stability and in addition to providing exceptional internal lubrication it blends with primary plasticisers having poor stability and flexibility to minimise these deficiencies.

Di-butoxyethyl adipate, di-2-ethylhexyl adipate and di-iso-octyl adipate are among the most important of new adipates. These impart permanent flexibility, good electrical properties, extremely low temperature flexibility, low water extraction, good heat stability, stability to ultra-violet light and easy processing.

The alkyl tetrachlorophthalates have been evaluated as plasticisers; the *n*-propyl, *n*-butyl, isoamyl, 2-ethyl butyl, 2-ethyl-hexyl and methoxyethyl diesters are non-migrating, flame resistant and particularly suitable for cellulose esters and nitrile-type rubbers.

MODIFYING SYNTHETIC RESINS

Useful Properties of a Newer Aldehyde

A GOOD deal of interest is now being shown in propionaldehyde. This, although well known to organic chemists, has not hitherto been available in large commercial quantities. Generally speaking, the aldehyde has properties midway between acetaldehyde and butyraldehyde, both of which are fairly extensively used in plastics manufacture, particularly for the production of vinyl resins, cellulose compounds and thermosetting resins.

The chief value of propionaldehyde lies in the fact that it may be used with advantage to secure modified properties in many plastics products where other aldehydes are normally used. So far, it has been used alone or in combination with other aldehydes in the synthesis of polyvinyl acetal type resins and thermosetting plastics. It is claimed that when used with formaldehyde in the phenolic resin condensation process it improves the flow characteristics and moulding properties of the powder produced.

Apart from its direct use in resin making, propionaldehyde is likely to play an important part in the manufacture of new chemical raw materials for producing alkyd resins, plasticisers and cellulose esters.

Under alkaline conditions the aldehyde will condense with formaldehyde to form a trihydroxy alcohol, penta-glycerol, which is superior to either glycerine or pentaerythritol in producing high grade ester resins for paint manufacture.

Another alcohol 2-methyl pentanol, can also be made from propionaldehyde by condensing the aldehyde with itself under alkaline conditions. In this way an aldol is formed which can be dehydrated and hydrogenated to form the hexyl alcohol. By direct hydrogenation the aldol will give the glycol 2-methyl 1, 3-pentanediol, which is now assuming growing importance in industry, chiefly because it forms diesters which are valuable as plasticisers, resins and emulsifying agents.

Propionic acid obtained by oxidation of the aldehyde is used in the manufacture of cellulose acetate propionate, which is finding some applications where cellulose acetate has not been particularly satisfactory. Generally, the mixed cellulose esters, notably cellulose acetate butyrate and cellulose acetate propionate, have better moisture resistance, increased solubility in a wider range of solvents, and a higher compatibility with gums and resins than the straight ester.

The acetate propionate is normally produced by esterifying cotton linters with the mixed acetate and propionic acids in the presence of acetic anhydride and sulphuric acid.

The boiling point of propionaldehyde is 48.8° C, flash point TAG open cup 15-19° F., and melting point −81° C. The specific gravity is 0.8066 and 20° C. and refractive index

$$n \frac{20^\circ\,C.}{D} 1.3636.$$

This aldehyde has a water solubility of 17 grams/100 c.c. water at 20° C. and is completely soluble in alcohol and ether.

Propionaldehyde usually contains a small percentage of propionic acid and a good quality comercial grade may have about 0.2-0.3 per cent of the acid present. The aldehyde has a suffocating odour and a toxicily comparable with that of acetaldehyde and butyraldehyde.

Reducing the Fire Hazards of Films

PROBLEMS of producing for cinematograph films a safe material which is slow burning and yet possesses satisfactory mechanical and physical properties have long been the concern of film stock manufacturers.

Attempts to produce such film have generally met with little success because the film became brittle after a few projections.

A new type of safety film, produced by Kodak, Ltd., and in small-scale use, holds out better prospects. It is claimed that the new safety material, unlike nitrate film, maintains its essential properties in use and in store. It has an exceptionally low rate of shrinkage. Splicing, however, is reported to be rather more difficult, requiring a special cement.

Inflammability of the new safety material is regarded as being equivalent to that of a roll of ordinary newsprint. It burns slowly and can be readily extinguished by normal means. Fumes produced in burning are not permanently damaging to human tissues, as those from a nitrate film may be.

CONSTRUCTIVE APPLICATIONS OF ATOMIC ENERGY

What are the Prospects?

by J. BERKOVITCH, M.Sc. (Tech.), A.R.I.C.

IF the world's present total energy requirement could be produced by the pure transformation of mass into energy only 0.1 tons of fuel per year would be required. If the energy were to come from U 235, 100 tons of it would be required, but if by thermonuclear reactions of nuclei of low mass (*e.g.*, H^+ as in the sun) only 10 tons of fuel would be needed. Since the world energy requirement is estimated to be about 2.5×10^{12} kWh, the vast potentiality of the atomic source becomes apparent. Other estimates have differed a little from this, but the order of magnitude has been the same.

Speculation

Atomic energy prospects remain enveloped in a cloud of speculation, so that the facts, including those which have come to light this year, deserve to be recorded. The historical basis is primarily associated with Röntgen's observations in 1896 of the fluorescence of a barium platinocyanide screen when exposed to X-rays. This gave rise to the train of work which led to the atomic bomb and the atomic pile.

Rutherford in 1919, after much intermediate work, achieved the artificial disintegration of nuclei by α-particle bombardment

$$^{14}_{7}N + ^{4}_{2}He \rightarrow ^{17}_{8}O + ^{1}_{1}H$$

This was found to be possible for a range of light elements, excluding carbon and oxygen. The α-particles, small, having high energy, occasionally hit a nucleus, producing disintegration. Now the physicists began bombardment with artificially accelerated particles, for instance, protons accelerated in cyclotron.

Artificially Induced Radioactivity

Discovery of artificially induced radioactivity by Curie and Joliot soon followed, in 1934. This has been represented thus:

$$^{27}_{13}Al + ^{4}_{2}He = ^{30}_{14}Si + ^{1}_{1}H$$

$$^{27}_{13}Al + ^{4}_{2}He = ^{30}_{15}P + ^{1}_{0}n$$

followed by

$$^{30}_{15}P = ^{30}_{14}Si + e^+$$

If the aluminium after bombardment is dissolved in acid the gas evolved is radioactive, due to the active phosphorus in the phosphine.

Neutrons penetrate readily and are readily captured, since there is no charge and therefore no repulsion to overcome. Fermi found slow neutrons to be more readily captured than fast. An early discovered reaction was

$$^{27}_{13}Al + ^{1}_{0}n \rightarrow ^{28}_{13}Al \rightarrow ^{28}_{14}Si + e^-$$

First samples of the "artificial" element plutonium were made in the cyclotron:—

$$^{238}_{92}U \xrightarrow{(d:\,2n)} ^{238}_{92}Np \xrightarrow{\beta} ^{238}_{94}Pu \xrightarrow{a} ^{234}_{92}U$$

In the pile

$$^{238}_{92}U \xrightarrow{(n:\,\gamma)} \text{ultimately } ^{239}_{94}Pu$$

(In this notation, the first symbol represents the bombarding particle, the second the emitted; d signifies deuteron, n neutron.)

New Elements

The new elements have provided a new radioactive decay series, the 4n + 1 series, which fills a gap in the known series 4n, 4n + 2 and 4n + 3. None of the members of this new series occurs in nature. The end product is Bi^{209}.

Electronic structure of the transuranic elements is analogous to that of the rare earth series. The "build-up" from one element to the next is by an increase in the number of electrons in the 5f shell, which is an inner shell, not in the outermost. Hence, in their chemical properties they are very similar.

The symbols and atomic numbers of the transuranic elements are these:—

Neptunium	Np 93,
Plutonium	Pu 94,
Americium	Am 95,
Curium	Cm 96.

The detection of radiations requires instruments, such as the Geiger-Muller counters for β and γ rays. The counter consists of a metal tube with a wire running through the middle, filled commonly with argon at 10 cm. pressure and a trace of organic vapour, and fitted with a window. The metal case is earthed, the centre wire charged to 100-1500 V. An ionising particle causes multiplication of ions by acceleration and collision and thus produces an amplified detectable impulse. The pulse is self-limiting, due to the formation of a space-charge. Scaling counters are used which apply to an electro-mechanical counter only one pulse in 10 or 100.

α counters consist of an electrical condenser, of which the plates are charged at about 1000 V. potential difference, the specimen being positioned between the plates. Each particle gives a pulse which temporarily lowers the voltage. This effect is used for the detection. Thus the α counter uses the direct ionisation effect but the β counter requires a multiplying effect.

Detecting Neutrons

Neutrons possess no charge and no ionising effect; they give no Wilson chamber track. Hence for their detection a secondary effect is needed. This may be (a) measurement of the radioactivity induced in indium or gold foil, or (b) detection of the α rays produced by permitting the neutrons to impinge on boron

$$^{10}_{5}B + {}^{1}_{0}n \rightarrow {}^{7}_{3}Li + {}^{4}_{2}He$$

A general review of instruments in atomic energy work has appeared in this journal.[2]

Applications of atomic energy can be regarded as being of two quite distinct kinds.[3] One is the use of atomic energy for large scale industrial production of electricity and possibly of other forms of power. The other benefit derives from the use of the "by-products" of atomic reactors, such as radio-isotopes. There is a very considerable difference between the two applications.

Power on an industrial scale means the use of large quantities of nuclear fuel and the production of very large quantities of heat. The world's needs of radio-isotopes could be supplied by an amount of atomic power which produced no more heat than would be necessary, converted efficiently into electricity, to supply a large village. The industrial application almost certainly involves the production of fissile substances on a large scale, and these could also be used for the manufacture of atomic bombs on a military scale. It has been stated, however, that the Harwell piles, which are capable of supplying all Europe's needs of radio-isotopes, could scarcely make a fraction of an atomic bomb in a year.

Uses of Isotopes

Uses of isotopes in investigations have been briefly reported in *Nature*.[4] Possible uses directly in industry have been referred to several times in the last year and there are indications of increasing actual use as more and more workers become trained in the technique. The ionising power of the radiations may be used to dissipate static electricity and has in fact been so used in textile, rubber and plastics factories. Sparks may be stabilised by the ionising power of radiation, for instance, in sparking plugs, but the spark voltage is not reduced.

At least two systems of liquid level remote indication have been devised using Po*. Thus, a float may be coated with the isotope and the ionisation current between this and another electrode measured. Current will decrease as the level falls, and the device can be calibrated to allow for decay. It is usable with inflammable liquids.

The penetrative power of radiation may be used as an alternative to X-rays for taking radiographs. Strong γ-radiation of La^{140} may be used for this purpose. Emitting weak β rays C^{14} is used as a source on one side, with a detector on the other side, for accurate measurement of plastic film thickness to better than 10^{-4} in. Similarly, measurement of the thickness of sodium oleate on textile fibres prepared for finishing processes is being carried out using Na^{24}. Use of these techniques for continuous measurement of liquid densities within closed pipes has been suggested.

The Tracer Technique

Use of tracers for analytical purposes has hitherto been thought of mainly as an academic technique. In fact, the principle is directly valuable for industrial investigations. The outstanding merit of the tracer technique is the very low limit of detection. For instance, while phosphorus cannot be detected below perhaps 10^{-6} g. (at the best), P^{32} is detectable down to 3×10^{-15} g. Thus, even with a millionfold dilution there is advantage in using it.

Investigations into the mechanism of rubber vulcanisation and into the source of sulphur in iron—from the coal or the

ore—have been carried out with active sulphur.

A recent report by Dr. H. Seligman[4] on "The Availability of Radio-Isotopes" indicates that the Atomic Energy Research Establishment at Harwell is now in a position to provide all the tracers of long life which a year or so ago could be bought only from the United States, as well as those of shorter life, which were previously not obtainable by purchase. The staff at Harwell also go to great lengths to help those with little experience in the subject, by giving advice as to the tracers likely to be most satisfactory in particular research problems and industrial uses. Prices are kept very low and it is, therefore, unlikely that establishments within reasonable distance from Harwell will ever be hampered in the use of radioactive tracers by lack of the necessary radioactive material.

Allocation of Isotopes

The Isotopes Allocation Committee, under Sir John Cockcroft, considers applications for isotopes.

Health records of all laboratories hitherto working in these fields are quite clean. It is evident that the assertions that there need be no greater risk in such work than in any other laboratory work have been well substantiated.

Dr. E. F. Edson has pointed out that there are six major groups of protective barriers and has discussed these:—

(a) Lay-out, design and construction of establishment, (b) operational routines and handling of radioactive materials, (c) training, education and supervision, (d) personal protection of the worker, (e) detection, measurement and control of radioactive hazards, (f) medical surveillance of workers.

In a symposium on "Safety in Laboratories," Mr. W. G. Marley (AERE) has given further useful guidance. He considered inhalation of radioactive material as constituting the major risk. Radiation is prone to attack the lungs.

Protective Clothing

At the same time, deposition in the body might also occur by ingestion or by skin absorption and appropriate safeguards—particularly the use of protective clothing—were necessary for these risks too. A "Film Badge Service" is now operated by the National Physical Laboratory for examination of X-ray film badges worn by all workers who may be exposed to radiation.

Periodical surveys of the laboratory for local contamination should give Geiger counter records of less than 500 per min. Removable bench tops, stainless steel working trays, special impervious flooring, protective clothing, rubber gloves, overshoes and a hat had all been found necessary for protection in routine work.

An important conference on this subject took place between representatives of Great Britain, the United States and Canada on hazards and safety in connection with atomic piles and related subjects at the Atomic Energy Research Establishment, Harwell (August, 1949).

The programme, which did not include weapons information, was mainly concerned with the potential hazards of atomic piles—a consideration which is always foremost in deciding location and design. Delegates to the conference discussed the treatment of radioactive wastes, the effects of radiation on plants, animals and human beings, and pile hazards which might arise from accidents, sabotage, or the failure of safety controls. So far, no statement has been issued.

The Ministry of Health has appointed a Radioactive Substances Advisory Committee under the chairmanship of Sir Henry Dale, O.M., F.R.S. This is to advise on measures to safeguard workpeople and the public generally against the danger of exposure to radiation from radioactive substances and certain irradiating apparatus.

Precise Measurement

This work clearly requires the employment of precise standards of measurement. Steps are to be taken to provide them in the new international standard adopted by the International Unions of Chemistry and of Physics and recently referred to in *Nature*.[5] As a temporary measure the "international curie" is to signify 3.6×10^{10} disintegrations per second, superseding all previous definitions. There are also proposals for ultimately defining and using the rutherford as a firm international standard.

Some doubt has been felt about the effectiveness of the Aspatron, a "miniature" pile, briefly described in this journal.[11] This device, resembling a large tea-urn and carrying a maximum load of only 34 lb. of uranium oxide, is intended as a source of radioactive isotopes of short life.

In the orthodox pile, in addition to a high neutron density, there is a considerable amount of gamma radiation which contributes nothing to the efficiency of the chain reaction and is therefore useless from the point of view of the utilisation of atomic energy. Design of this new

small unit has been directed towards using gamma radiation to good effect.

It is known that certain elements respond more readily to this so-called "photo-disintegration" than do others. The particular element employed in the Aspatron has a relatively high gamma-neutron cross-section and a disintegration threshold-energy apparently slightly lower than the theoretical value. The Aspatron is intended to make effective use of the gamma-neutron exchange process, and so enhance the efficiency. Normal sources of neutrons (fissionable nuclei) are also present and the useless capture of neutrons by the copper in the assembly is guarded against by the critical "thinness" in construction.

Official comment on these claims is reserved. Sir John Cockcroft, however, has made it clear that calculations and measurements related to similar principles during the last 10 years by the Department of Scientific and Industrial Research have not been rewarding.

The revolutionary suggested use of atomic energy for power purposes is for the propulsion of rockets, which has been the subject of a series of articles in the *Journal* of the British Inter-planetary Society.[6] The one conspicuous fact here is the existence of great technical difficulties, which are shared by all such mobile power projects, in which massive shielding is clearly impossible.

U.S. Pilot Plant

According to Mr. T. R. Hogness, director of the Institute of Radiobiology and Biophysics of the University of Chicago, the U.S.A. will have an atomic energy pilot power plant of at least some hundreds of horsepower within five years, and one or more plants of 100,000 horsepower, or more, in 20 years. Assuming that the atomic energy power plant will use the breeder principle, operations (including refining) could cost $10,000 per lb. While plant costs would be high, labour costs would be relatively small after the plant is built.

The Argonne laboratory in Chicago has completed an engineering design for an experimental breeder reactor which will be finished in about a year. The breeder reactor will test the feasibility of breeding with fast neutrons. It is claimed as the biggest step forward in the peacetime application of atomic energy.

It is theoretically possible with this reactor to convert U.238 into usable material. At present only about 0.7 per cent of natural uranium is usable, the rest being U.238. If wholly successful, the breeder reactor will use the whole of natural uranium and thereby multiply by 140 the amount of usable material. It appears unlikely, however, that this result will be achieved. These experiments may nevertheless be an important factor in easing the problem of increasing the supply of fissionable material.

For more than three years, American industrial scientists have been working with the Oak Ridge National Laboratory and more recently with the Argonne National Laboratory to lay the groundwork for a special atomic power plant for naval ship propulsion. Detailed engineering designing will begin in about a year and it is hoped that construction will be under way by 1952. The ship-propulsion reactor will be a single-purpose machine designed to produce large amounts of heat for conversion into power.

Economic Aspects

The much more difficult and far-reaching part of the problem, the economic aspects, have been receiving serious study. While it is difficult to summarise their arguments here, a number of important references are given.[7]

Electric generating stations are expected to present the least difficult of the problems of peaceful utilisation, and a leader as cautious as Sir John Cockcroft, the head of the Harwell research establishment, is able to foresee the existence of such experimental power stations within the next few years. In those conditions, he notes, the present energy consumption of the world could be met by the complete fission of as little as 250 tons of uranium a year. In the U.S. Atomic Energy Commission's report of a year ago it was felt safe to say that if the present effort to build breeding reactors meets with success it should be possible, with uranium costs at their present level, to create a new fuel industry greater than that based on coal, and at a lower selling cost.

Industrial Blasting

The possibility that atomic material can be used as a "super industrial explosive" is suggested by the official explanation of the U.S.S.R. of the atomic explosions in Russia. The Soviet officials and official news agency claimed that the first explosion was carried out for industrial blasting. The Soviet-licensed Berlin paper *Nacht-Express*[10] soon carried what was represented to be a detailed story of the location and purpose of this explosion. Two giant dams, 800 miles apart, are being

built at Turuchansk, on the River Yenisei, and at Troytskoye, on the River Ob. It is claimed that, by moving obstructions by atomic explosion electric power on a scale greater than that from the Dnieper Dam will be made available. The flow of the Tubol River, it is said, will be reversed and an area the size of France—at present desert—between the Aral Sea and the Caspian Sea will be irrigated and rendered fertile.

If successful application of atomic energy for industrial blasting has in fact been made in the U.S.S.R. great technical problems associated with contamination must have been faced.

In this survey main emphasis has been placed on British developments. Great Britain is now operating no fewer than six atomic centres. It must be borne in mind, however, that France is now operating a pile under Prof. Joliot-Curie. During November, 1949, the French Atomic Energy Commission announced that its "plutonium factory" at Le Bouchat, 30 miles south-east of Paris, had produced its first milligram of plutonium, in the form of a purified salt. Further, the commission announces that the atomic pile at Chatillon (France's first atomic pile near Paris) is in a position to furnish regularly similar or slightly larger quantities of this element, which will be used in scientific and technical research on the peaceful applications of atomic energy.

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[10] *Nacht-Express*, November 5, 1949.
[11] *Chemical Age*, November 19, 1949, p. 697.

In this survey, the author has avoided any reference to the operation of atomic piles, since these matters have been extensively dealt with in the literature and little fresh information has been disclosed during the year. Apart from a brief historical résumé, the article is devoted mainly to new disclosures during this year, which have bearing on industrial utilisation of atomic energy and its products.

Chemical and Physical Research in South Africa

CONSIDERABLE development in the staff and in its laboratory facilities is reported in the third annual report of the South African Council for Scientific and Industrial Research 1947-1948, which has now been made available.

A wide variety of studies was undertaken by the National Chemical Research Laboratory including the investigation by modern techniques of South African clays of industrial importance.

Apparatus was constructed for the routine measurement of the surface area of paint pigments and for the measurement of surface areas by gas absorption. Attention was also directed to the chemistry of chromium and the citric acid fermentation of cane molasses.

Development of the organic chemistry division was hampered by lack of chemicals, but preliminary studies of wool wax were devoted to the elaboration of analytical methods. The general outlines were determined of the structure of a phenolic component of the timber of *Chlorophora excelsa*.

In the National Physical Laboratory instruments were developed for logging temperature and radioactivity in boreholes under conditions peculiar to South Africa and also for determining very low concentrations of radioactive substances.

A method was evolved for rapidly determining the elastic properties of wool and other textile fibres under dynamic conditions involving no permanent set.

Experiments on the action of hydrogen peroxide on bacteriophage were carried out and, with the aid of the Geiger counter X-ray spectrometer installed in March, 1948, an extensive survey was made of particle size determination. Biological work with phosphorous-32 was also undertaken.

An inquiry into the present and future demand for various types of research workers in South Africa was made by the Research Committee of the Federated Chamber of Industries, which provided a valuable link between the council and industry.

The application of vermiculite in building was reviewed by the materials division, which also investigated the protection of building timbers and the damage done by termites in South Africa.

WIDENING FIELD FOR CATECHOL

Industrial and Medicinal Uses of Phenol Intermediate

WELL known to research chemists for many years, Catechol ($C_6H_4(OH)_2$) is a dihydric phenol which only recently has become available in commercial quantities for general use as an intermediate in the chemical industry.

Of the three dihydric phenols, catechol, hydroquinone and resorcinol, catechol is the most active reducing agent. It reduces solutions of a number of heavy metals, with the precipitation of the metal in a finely divided state. This property is the basis for its use as a photographic developer and as a reagent in the preparation of colloidal suspensions of metals.

In the pure state catechol is a white crystalling solid having a specific gravity of 1.34, melting point 104° C. and boiling point 245° C. at 760 mm. mercury. It is soluble in water, alcohol and acetone but insoluble in ethyl ether and only slightly soluble in benzene, chloroform and carbon tetrachloride. The commercial form of catechol is usually available in two distinct grades—ordinary grade suitable for chemical manufacturing and processing uses, and resublimed grade for medicinal pharmaceutical and photographic purposes. Re-sublimed catechol generally has a minimum purity of 99.6 per cent, against 99 per cent for the commercial phenol: water insoluble matter is about 0.05 per cent maximum for all grades.

Ready Reactor

Catechol is gaining increasing importance in the manufacture of pharmaceuticals dyestuffs, photographic chemicals, rubber vulcanising agents and antioxidants and additives for lubricating oils. Like the monohydric compounds, catechol will undergo typical reactions, such as alkylation, bromination, etherification and oxidation. The dialkyl derivatives of catechol prepared by reactivating the phenol with olefines, alkyl halides, alcohols or esters, or by the reduction of acyl catechols are today assuming considerable importance as antioxidants, polymerisation inhibitors and pharmaceutical intermediates.

One of the products of etherification is piperonal, a perfume synthetic with the odour of heliotrope. This is prepared by first reacting catechol with methylene dichloride to form catechol methylene ether. This is heated with formaldehyde and hydrogen chloride to give piperonyl chloride, an intermediate in the production of piperonal.

Another important method of synthesing piperonal or methylene-protocatechnic aldehyde is by reaction of catechol with chloroform and an alkali hydroxide to form protocatechnic aldehyde (Reimer-Tiemann Reaction). When the dipotassium salt of the aldehyde is reacted with methylene iodide or methylene chloride piperonal is produced.[1]

Other Derivatives

Important pharmaceutical products such as adrenaline and related pressor active compounds, can be produced commercially from chloroaceto catechol. This is made with chloroacetyl chloride in the presence of zinc chloride.

According to Miller, Hasting, Rock and Crossley,[2] the n-heptyl ether of catechol and the alkyl derivative, 4-n-heptyl catechol have phenol coefficients of 37 and 77 respectively when tested against *Staphylococcus aureus*.

Synthetic resins and synthetic tanning agents can be prepared from catechol. Apart from the condensation products obtained by reacting catechol with formaldehyde and acetaldehyde, the monomeric catechol esters containing an unsaturated alkyl group can be readily poymerlised to form products of interest as laminating resins, etc.[3]

An interesting and recent application of catechol condensation products is for the treatment of nylon fabrics to improve their light stability. By condensation of phthalic anhydride with catechol it is possible to obtain two dihydroxy-anthraquinones, of which hystazarin is produced in larger quantities than alizarin.

According to Houben Fortschritte der Heilstoffchemie, part 2, page 201, catechol produces a rise in blood pressure, a slowing of the pulse, and an increase in the blood sugar concentration. In the U.S.A., Koppers Company, Inc., which produces large quantities of catechol for general industrial uses, states that it should be handled with the normal care given to an industrial chemical and that contact with the skin and inhalation of dust or vapour must be avoided.

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The Fuel Industries in 1949

Operations of the Collieries and Coke Ovens

by G. E. FOXWELL, D.Sc., F.Inst.P., F.Inst.F.

THE year 1949 generally has yielded easier coal supplies than any of its predecessors. It is true that the quality of the coal supplied to industry has continued to leave a good deal to be desired, but there has been a greater readiness " to spare the pianist since he was doing his best."

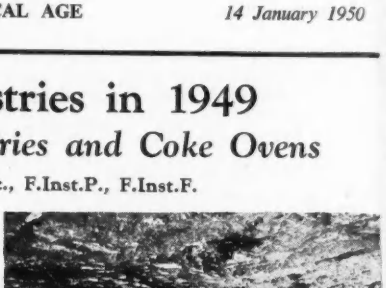
For many reasons, washery plants at the vesting date were insufficient in capacity to deal with the tonnage of coal raised. The growth of mechanical methods of mining has considerably increased the amount of dirt raised and further overloaded already under-capacity washeries. The traditional method of measuring mine output by weight has militated against the production of cleaner coal, greater output can be achieved by taking less care to leave stone underground. The genius who could devise a means of satisfactorily measuring the colliery output in therms would be a benefactor of all coal users. Very large sums are being spent in building new washeries and there is no doubt that coal cleaning will at length be very satisfactory.

Revaluing Coal Types

In pursuance of the announcement, that a new price structure for coal was to be set up, much technical work is being done towards the revaluation of some 8000 coals which must be analysed, classified and placed in an order of merit. The price structure cannot be based wholly on technical evaluation of the properties of the coal but must be based also on economic and commercial facts.

Whether prices should be based on pit-head prices or upon zone-delivered prices, taking into account the scientific evaluation factors, remains a subject of controversy. During the year, opinion appears to have hardened in the general direction of pit-head prices based on technical evaluation, largely on the ground that uniform zone-delivered prices may be unfair to those who have taken the trouble to site their works in a particular district in order to get whatever advantage can be obtained by reduced transport costs.

In the technical evaluation the coals will be classified according to size, method of preparation for the market and rank,



The Joy-Sullivan mechanical cutter represents a U.S. design to accelerate coal raising now made under licence in this country

these between them determining the main use of any coal. It will be possible to put each of the 8000 coals into four classes of use : gas coals, coking coals, general industrial coals, and house coals.

Within these groups the coals will be placed in an order of merit based generally on a comparison of the heat content, but account will also be taken of properties which are important to particular users. In gas making, the yield and quality of the gas are the prime factors; whereas for the manufacture of metallurgical coke coking power is the quality sought. This may be described as the " convenience " value of coals, a criterion suggested by Dr. E. S. Grumell (late of I.C.I., Ltd.), in papers before the Institute of Fuel.

After every coal has been provisionally allotted a place in the schedule of relative values, it will still be necessary to re-examine the schedule in the light of commercial experience, to include such characteristics as are difficult to assess scientifically, but have a considerable effect on their value to consumers. Size-distribution, physical hardness, friability, porosity, liability to spontaneous combus-

tion, etc., are typical qualities of this kind.

This work was in fact so far advanced a year ago that a price structure might well have been issued already. Certain difficulties, and the reactions of the largest users to the price structure proposed, have caused the National Coal Board to withhold final decisions. Some immediate anomalies, however, have been removed. These arose from the fact that, during the war, whenever increases in the price of coal became necessary, the Ministry of Fuel sanctioned a flat rate increase in shillings per ton, irrespective of the character of the coal to which it applied. This has resulted in the lowest grades of coal becoming unwanted. The price adjustments that have been made during the year have been designed to remove this fault as far as possible.

The NCB is now working on a general national plan which should be completed by the end of this year. It represents an attempt to adjust the future supply of coal to demand at the lowest possible cost to the country. Generally it may fairly be said the NCB appears to be tackling its problems with vigour—and now with some foresight.

Coke Ovens

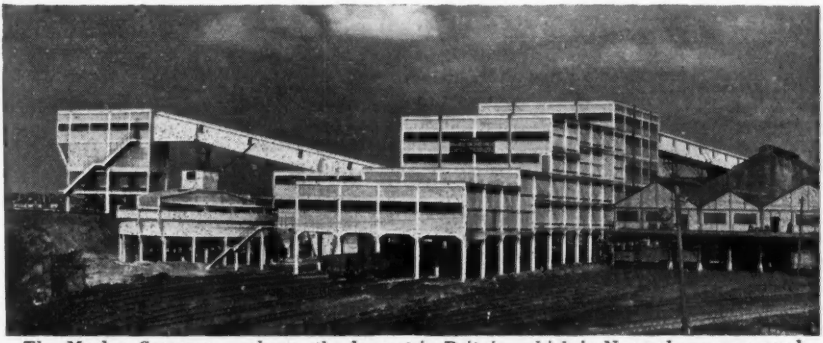
The coke oven industry continues susceptible to being divided between NCB plants and those owned by the iron and steel industry—and a few others. The plants which the iron and steel industry have controlled in 1949 are generally modern, their size and method of operation designed to perform a particular function in the integrated iron and steel works. Most of the plants owned by the NCB are not modern. Difficulties of reconstruction, rebuilding and even of maintenance during the war have placed these plants in urgent need of extensive rebuilding.

R. J. Barritt has pointed out, during the year, that, with very high capital costs for new modern plant, it is rarely possible for a colliery to rebuild completely plants of the existing size and operate them at a profit. The minimum economic size of a coke oven battery requires a capacity of between 1000 and 1500 tons of coal a day. The logical development, if the present economic conditions continue, is that the comparatively small plants now owned by the NCB should gradually be replaced by a smaller number of large central plants drawing their supplies of coal from a number of pits in the neighbourhood. Greater use will be made of blending plant and coal preparation for coking will become a scientific operation.

Inferior Coals

One of the problems of the coke oven industry is the economical use of coals of inferior quality. The solution probably lies in coal preparation, including cleaning, fineness of grinding and blending. Potentially an important factor is the fact that when a coal is partly hydrogenated—and this applies also to non-coking bituminous coals—it becomes plastic or even molten, and on cooling is found to have acquired coking properties in very high degree. It is not impossible that in the future, as our best coking coals are worked out, it may become the practice partly to hydrogenate a percentage of the coal used for carbonisation, by the aid of the end gases rich in hydrogen, and to blend this hydrogenated material with the bulk of the coking coal. Preparation of coal for carbonisa-

(*continued on page 74*)



The Mosley Common washery, the largest in Britain, which in November was geared to clean 600 tons of coal per hour

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GAS ENGINEERING PROBLEMS

Closer Links with Chemical Industry

THE narrow boundary which is supposed to distinguish the main activities of the gas industry from chemical engineering has been rendered a great deal harder to define by many of the trends in commercial gas production during 1949.

The nature of the engineering problems in particular have rendered much closer the similarity of interests of gas and chemical producers, which the profound influence the expanding petroleum refining capacity may exercice on both promises to intensify.

Oil Refining Gases

Two of the gas industry's principal problems, meeting high peak demands and the removal of hydrogen sulphide from the normal product, will be substantially eased if oil refining gases become abundant. In that respect gas undertakings are capable of becoming competitors, in the quest for raw material, with some of the chemical synthesis enterprises of the future.

The petroleum industry, when all current refinery schemes are implemented, should be able to refine in this country about 20 million tons of petroleum a year. In the course of doing that large quantities of permanent gases are likely to be produced having a calorific value between about 900 and 1500 BThU/cu. ft.

It has been calculated that the quantity of these gases that might be made available when the full refinery programme is in operation could represent the equivalent of about one-quarter of the total thermal value of the gas now sold by the gas industry. If this gas could be made available for enrichment purposes in the gas industry—as some indeed is—it would greatly reduce the amount of capital expenditure required over the next few years.

Manchester's Intake

During this year Manchester has taken gas of 890 BThU a cu. ft. in amounts which will ultimately rise to 600,000 cu. ft. of gas a day from the Caterole process of Manchester Oil Refineries, Ltd. Ellesmere Port gas undertaking is buying daily 60,000 cu. ft. of gas of 1500 BThU a cu. ft. from the Ellesmere Port refinery of Lobitos Oilfields, Ltd. In addition to this refinery gas it is likely that in the future there will be available considerably greater quantities of coke oven gas and this amount may well be of the order of 15,000 million cu. ft. over the next 5 or 6 years—according to H. D. Greenwood, who also calculates that if the gas industry takes the fullest advantage of coke oven gas it can save an expenditure of some £7 million which would otherwise have to be spent on new carbonising plant at gas works.

Gas shares with chemical industries a further common interest—the high capital cost of the increasingly elaborate plant now considered necessary for securing high quality production and more economical working conditions. That applies equally, of course, to coke ovens. In gas industries it is now being asked if all the cost-raising refinements are essential, in view of the necessity to produce more gas quickly. That, however, is a viewpoint chemical industries are most unlikely to share, in relation to their own affairs.

The curious and in some ways unfortunate emphasis that is now being placed on total gasification is partly due to the insistence of the Gas Research Board in pursuing its own total gasification ideas, based on the Lurgi plant and the (very necessary) effort to " sell " that idea.

Total Gasification

The present writer would not for one moment disagree with the pursuance of this work, for it is a function of the Gas Research Board to reach out into the future and to be ready for whatever may befall. Many industries have died at the hands of a competitive product because they have not been ready to take the necessary action in their own defence.

A method of making gas that enables gas to be the main thermal product (whereas now it amounts to only one-third of the therms produced), and to be made from any type of coal, even low-grade colliery rejects, may well be essential 20 or so years hence. But the emphasis placed on total gasification in order to justify the work to the average engineer will be a positive disservice to the industry if it results—as it appears to be doing—in the belief that coke is a product no one wants.

Coke and gas together given the cheapest means of smokeless heating.

The Gas Research Board has been actively at work on two major processes of gas-making. (1) Gasification at high and low pressures, with or without the use of oxygen, with the fuel in static beds, fluidised or fully entrained, and with hydrogenation; (2) the catalytic synthesis of methane, as enrichment processes.

Consideration of these processes indicates that the gas industry is travelling fast in the direction of chemical engineering, and it is not surprising that at the Autumn Research Meeting there was a vigorous protest, which drew much applause from the large gathering of gas engineers present, against the present policy of the Institution of Gas Engineers of linking its examination syllabus too rigidly with those of the great civil and mechanical engineering institutions, and neglecting linkage with the Institution of Chemical Engineers.

The gas industry can hire civil, mechanical and electrical engineers, it was declared, but gas engineering is now fundamentally a branch of chemical engineering.

Much of the Gas Research Board's work on the gas making processes has been conducted on what may be described as the semi-manufacturing scale. The first process involves work on the hydrogenation of coal and semi-coke during the process of coking, *i.e.*, at elevated temperatures, with production of methane, as in the Lurgi process.

Synthesis of Methane

Operation under pressure has been envisaged to bring about the synthesis of methane by the interaction of the primary gaseous products, hydrogen and carbon monoxide, with coal or coke. Work has been conducted on a static generator using a weakly-caking coal and semi-coke.

The conclusions announced during the year were that the non-coking coal could be successfully treated at 50 atmospheres pressure and that under the conditions employed, 38.8 per cent of the coal is gasified by 33,000 cu. ft. of hydrogen per ton of coal treated, giving 40,000 cu. ft. of gas at a CV of 493 BThU/cu. ft.

In all, the yields from a ton of dry coal were 197 therms of total gas, of which 111 therms was methane, and 90 lb. of sulphate of ammonia was produced simultaneously.

Work is now in progress to enable a non-static generator to be used, and in particular to use the fluidisation technique. In a complete system operated on the fluidised bed principle, oxygen-steam blast would be used for the complete gasification of hot coke leaving the process, to produce from it a mixture of hydrogen and CO. This gaseous mixture, at high temperature, would react under pressure (*e.g.*, 50 atm.) with the raw coal entering the system. The coal would be distilled, methane would be synthesised from hydrogen and the carbon in the fuel, giving a gas suitable in CV for town use.

As an example, at a reaction temperature of 900°C. and at 25 atm. pressure, if the gas is preheated to 665°C., 18 per cent of CH_4 is made. It may be long before these experiments can be considered sufficiently complete to employ the fluidised process on the manufacturing scale. One prior necessity is for sufficiently cheap oxygen.

Oxygen Costs

This is a subject on which information is conflicting. Dr. King, director of the Gas Research Board, delivering the William Young Memorial Lecture, said: "In a recent paper to the American Gas Association Conference, C. C. Wright has quoted costs in the U.S.A. (for 250 tons of O_2/day) of $4-5 a ton, or 17-21c./1000 cu. ft. At this scale, which would mean about 200,000 therms of town gas a day, the cost of oxygen does not seem to be out of the question for base load gas. . . . It is still doubtful, however, whether a plant requiring oxygen could be other than a base-load plant, since a modern oxygen plant cannot be started from scratch in less than 10 hours and its flexibility under running conditions is not more than ± 25."

It may be added that the capital costs of the combined plant might well be sufficiently high at present to rule out anything other than base load operation.

The Gas Research Board has also brought to the pilot plant stage—in this case to a stage at which the process is claimed to be ready for large-scale application—the process for synthetic catalytic production of methane, using the reaction: $CO + 3H_2 = CH_4 + H_2O$. Complete details of the pilot-plant experiments were given to the Autumn Research meeting of the Institution of Gas Engineers by Dr. F. J. Dent and Dr. D. Hebden.

Methane Plant

The technical process appears to be established and it remains for an Area Gas Board to undertake to erect a plant in order to determine its economic value. Synthesis gas in the proportions given in the foregoing equation is passed over a nickel catalyst, means being adopted for temperature control by circulation of

cooler gases, and for the prevention of carbon deposition on the catalyst.

The immediate application foreseen for this process is in place of oil for the enrichment of blue water gas; since the total gaseous thermal output of a carburetted water gas set on oil is decreased when using methane for enrichment, the CWG set must presumably return to oil operation when meeting peak loads. The economics of the process cannot be decided unless large scale trial is made.

Catalyst Cost

The technical results achieved on the pilot plant may be seen from figures given in the paper mentioned. Operating at a space-velocity of 2000 vol./vol./hr. a final gas of 500 BThU/cu. ft. was made at atmospheric pressure; when operated at 20 atm. the CV was over 700 BThU/cu. ft.; in each case the experiment continued for four months without any appreciable deterioration in the CV. With a catalyst life of this order, the catalyst cost should be no more than 0.3d. a therm.

Electrostatic precipitation of tar fog is now established as a regular part of the by-product recovery system of coke ovens and gas works. The whole gas purification process is becoming more of a chemical engineering job than ever before, partly because of the need to deal properly with the large volume of effluent liquor produced.

K. W. Francombe has discussed electrostatic precipitation of tar in an exceptionally valuable paper and there have been several good papers on the general subject of by-product recovery, gas condensation, etc.

Those who do not operate in the gas industry may be interested to have some indication of modern plant and processes, many of which illustrate that the gas and coke oven industries are becoming branches of chemical engineering.

The gas leaving the retorts is sprayed in modern practice with hot aqueous liquor, thereby replacing its high-temperature sensible heat by the latent heat of steam. The hot gases are then passed through a detarrer to remove the bulk of the higher tar acids (polyhydric phenols) before the aqueous liquor condenses. The last is of the greatest value in producing a reasonably good effluent.

Condenser Design

The gas is cooled in condensers, requiring considerable care in their design to remove the bulk of the water vapour from the gas. The gas passes through an exhauster, and through a second electrostatic tar precipitator (this time on coal gas) to remove the last traces of tar fog that may have condensed, since the gas passed the hot gas precipitator. Ammonia is washed from the gas, either by water, in gas works practice, or by acid, as in general coke oven practice.

Reference must be made to an excellent paper on gas washing, by C. Cooper, who shows that generally, unless the cost of disposal of ammonia liquor is very high, it pays to reduce the size of the washers and to use more water. Benzol recovery (which may come before or after the removal of hydrogen sulphide) involves an oil washing process, and here Cooper has concluded that it is better to use large scrubbers and smaller amounts of oil, because of the cost of steam for distillation.

Attempts are being made to apply fluidisation to the oxide purification process. The liquid purification process now in operation at Manchester gasworks, and developed there by R. Walker and his colleagues, is being built at several gasworks and coke ovens, notably at Liverpool gasworks, which will be the next of these plants to be in operation. Several other attempts are being made to develop flow processes for removal of hydrogen sulphide from town gas.

It has been suggested, however, that what is wrong is not the use of iron oxide for removing hydrogen sulphide from the gas but that the chemical engineering of the oxide process needs modernisation and improvement.

The Gas Research Board (and others) are now working on the extraction of sulphur from spent oxide by solvents, with a view to providing the chemical industry with elementary sulphur in a suitable commercial form.

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(*continued from page* 71)

tion thus seems likely to become even more of a chemical engineering process.

The British Sulphate of Ammonia Federation's research department is endeavouring to cheapen the cost of sulphate of ammonia by economy in steam and reduction in maintenance. The use of special metals for construction of saturators and measurement of steam consumption are both yielding some useful rewards. J. Bell (in a paper to the Coke Oven Managers' Association) has described the work of this research organisation. The disposal of coke oven gas, and the method of collaborating with the gas industry as enjoined by the Gas Act, 1948, have been the subject of much anxious thought.

THE SOAP AND OIL INDUSTRIES

Continued Shortage of Animal and Vegetable Fats

WORLD-WIDE shortage of animal and vegetable oils and fats continued to dominate the soap and oleaginous industries in 1949. Strenuous efforts have been made during the year in nearly all contributing countries to increase acreage and acreage yields of oil-bearing crops. That drive has been especially evident in the British Empire, the French overseas territories, India, South America, and the Far East.

Some quick results have been recorded, where they depended upon annual crops, but where the source has been trees or shrubs, taking several years to mature, there has been no marked increase.

World Oilseeds

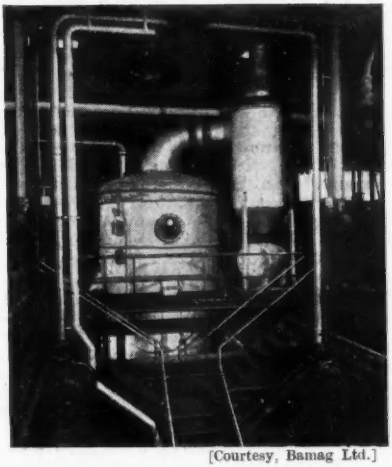
World production of the principal oilseeds and nuts in the war and post-war periods was the subject of a recent review in *Oleagineaux* (1949, 4, 169) with pre-war figures for comparison. World yields were estimated to have been :—

	Thousand tons		
	1934-38 average	1947	1948
Groundnuts ...	8,060	9,800	9,900
Colza or rape ...	3,760	4,051	4,300
Copra (including oil)	1,811	1,479	1,241
Cottonseed	13,356	10,740	12,450
Linseed	3,428.5	3,570	4,153
Olive oil	857.2	1,129	1,022
Palm oil (exports) ...	447.35	261	330
Palm kernels	709.2	545	555
Sesame seed	1,393.3	994	1,000
Soya beans	11,842.8	13,350	14,000
Sunflower seed ...	2,309.3	3,471	4,409

These figures are thought to represent about 95 per cent of the world total. Although the totals in several cases exceed those of pre-war years it has to be remembered that there was before the war a substantial shortage, notwithstanding the relatively low level of consumption of fats and soaps in many countries.

Indian Exports

One of the factors contributing to the shortage is the defection of India, formerly an important supplier. Recently India has nearly ceased to be an important exporter of oilseeds; and under the current five-year plan export of oilseeds, especially of groundnuts, is prohibited or discouraged, in favour of the home oil-milling, soap, and other industries to be developed. Of all the major oilseeds it is intended that much larger areas shall be cultivated and yields per acre increased. Equally vigorous efforts are being made to increase supplies from the French overseas territories and in other countries.



[Courtesy, Bamag Ltd.]

10-ton deodorising plant

In his informative annual survey of the oils and fats position, the chairman of Lever Bros., Ltd., Sir Geoffrey Heyworth, stressed the importance of a proper valuation of stocks and fixed assets under present conditions, and gave rather more conservative figures for world production than are shown in the above table. The shortage of at least 4 million tons which prevailed in 1947 still persists and has probably been increased, bearing in mind that world population has increased by about 8 per cent.

A complication of the world position has been the existence of two price levels and two markets, one of dollar countries and the other non-dollar. So far as Europe was concerned, the Marshall Plan ensured exports of oils and fats to Europe between April 1948 and May 1949 to the value of $250 million. Much of this went to W. Germany which was enabled to increase its margarine output to 250,000 tons in 1949 (120,000 tons in 1948.) The great problem continues to be the removal of restrictions and artificial price levels and the return to one world market for oils and fats.

Another comprehensive survey was that of Mr. P. H. Faure, secretary of the International Association of Seed Crushers (*Oléag.*, 1949, 4, 567-570).

Total world exports of oils and fats were nearly 3 million tons in 1948, more than two-thirds of which came to Europe.[1] Total world exports this year were estimated at about 300,000 tons larger, and in 1950 there may be another increase of 270,000 tons.

Despite the enormous production of soya beans, still the main crop in Manchuria and now one of the main crops in the U.S.A., little becomes available for export. Mr. Faure has urged that production must be vigorously increased in the weak exchange (non-dollar) countries and foresees that the great increase in manufacture of synthetic detergents may ease the position a little.

The Indian policy favouring export of oils rather than oilseeds, to develop the home oilmilling industry, may well be extended later to include soap, margarine, and other fatty oil industries, so that even vegetable oil exports may be limited. Already it is proposed to raise Indian soap production to 300,000 tons a year.

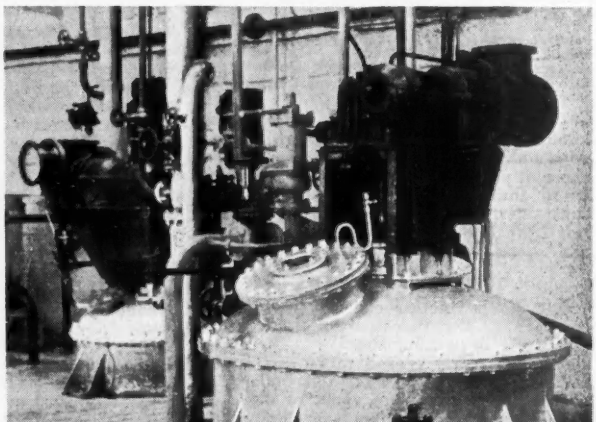
No outstanding advance has been made in oil expressing and solvent extracting during the year. Much has been written of the achievements of the past few years, in which American and Continental engineering firms have perhaps secured more publicity than the British makers.

One of the greatest drawbacks to the Indian development plan is stated to be inability to secure sufficient machinery and plant, especially for oil-milling and soap manufacture. An interesting and fairly comprehensive account of the oil-milling industry, with particular reference to American and French machinery, was given by Y. Bagot, at a conference in Marseilles in 1948, and in the previous year at the Centre de Perfectionnement.[2]

Bagot compares modern expression methods, *e.g.*, the continuous process, with solvent extraction. To a certain extent rivals, they are in other respects complementary. It is now common practice to combine the processes, first expressing and then recovering the balance of the oil (or most of it) from the cake by solvent extraction.

Many papers have been read and patents issued, mostly in connection with solvent extraction, and solvent recovery. Interest has attached to the Japanese work on alcohol extraction of soya bean[3] and to solvent extraction of crude lipid from oilseeds.[4]

A great deal of material has been published on oxidation, polymerisation, etc. Eckey and Formo,[5] on inter-esterification, reported on a directed method in which ester interchange is effected in



Indicative of the size which modern processing plant has reached are these two working heads of (right) a hydrogenation autoclave and (left) a catalyst reducer. Both these installations occupy the whole depth of the floor below

[Courtesy, Bamag Ltd.]

triglyceride mixtures with simultaneous crystallisation of solid glycerides. The mixtures contained free hydroxyl groups. The principal governing variables are indicated. It was possible to segregate high and low melting fatty acids into separate ester fractions.

Variation of chemical reaction with temperature during oxidation and polymerisation of fatty oils was investigated by Gillam[6] continuing earlier work. Published data on oxidation products of unsaturated fatty oils were reviewed in some detail, with a classification in four groups.

Autoxydation of linoleates formed the subject of a publication of the Hormel Institute, Minnesota, by W. O. Lundberg.[7] One of the objects of this study of reaction mechanisms was to determine the kind of anti-oxidant required in food preservation wherein fatty oxidation is to be expected. Phenolic anti-oxidants appeared to be relatively ineffective.

At the IRHO in Paris, Loury and Mellier[8] studied the evolution of peroxides during autoxidation of fats. When the fat is heated to about 80° C. the peroxide index undergoes considerable variation, irrespective of the oxygen absorbed, so there may be two forms of peroxide in the autoidised fat: one thermolabile and the other thermostabile. Lea's index does not allow such distinction.

Retarding Oxidation

In connection with elaidinised fats, Bertram[9] investigated their keeping qualities by rate of peroxide formation. The causes are both chemical and physical. Traces of Se have been found to have strong anti-oxidising action, especially if traces of metal are eliminated. Elaido-configuration of unsaturated acids was, however, the principal factor in retarding oxidation. The polarograph has been used to distinguish peroxide structures in oxidised fats. Lewis *et al.* found at least three different forms present in the early stages.

Among the numerous applications of ultrasonics must be included the emulsification of fatty oils, the technique of which has been described by Anouin and Levasseur,[10] using the SCAM projector. Frequency played a predominating part—within the range used by the authors, namely 187 KHz to 6 MHz.; and the progressive are much more interesting than the stationary waves. Some research on the effect of using pairs of emulsifying agents was undertaken by Jellinek and Anson.[11] Different types of emulsions are thus promoted, and complexes formed at the interface, reducing interfacial tension more than either of the agents do alone. The capillary height method was used for measuring the interfacial tension of liquid paraffin and water at 70° C.

In the important field of hydrogenation Russian work has been published on hardening seal fat (Caspian Sea) and on polarographic determination of Ni and Cu in hardened fat.[12] Those pioneers in fat-hardening, the De No Fa Co. (with C. F. Holmboe) have patented further improvements in English Patent 620,043, 620,145, and 619,961. Greater speed and more heat economy are claimed in EP 621,037 by d'Astecky Callery. The Lever Bros. Co., of the U.S.A., in U.S.P. 2,468,709 describe the use of a new catalyst with a relatively large content of sulphur.

Adsorbent Activity

Research on adsorption and other methods was continued by, among others, Stout.[14] From the point of view of adsorbent activity, acid-activated clays are generally 1½ times more effective than natural earths, at the optimum temperature of about 100-106° C. for the clays and 118-132° C. for the earths, except with high Si earths, when optimum temperature is 180-250° C.

An interesting account of the use of sodium chlorite for bleaching, largely employed in the U.S.A., was given by Mouton and Borezee.[15] There are several variations: with the chlorite alone, activated with acids, salts, persalts, hypochlorites, direct with chlorine dioxide, and with various modifiers (reducers, etc.). The Mathieson Alkali Works, which has lately taken out many patents for ClO_2, is among the American leaders in this field. This work includes, of course, the use of effective oxidation inhibitors, such as wheat germ oil, oat extracts, etc., and it covers both vegetable and animal oils as well as soaps.

American Methods

The American Oil Chemists' Society has published during the year a number of reports on methods and several articles of value, such as: determination of free glycerol in soaps, by Pohle *et al.* (376-8); determination of K in soaps and mixed caustic lye, by Miller and Andrews (309-312); estimation of peroxides in oils and fats by ferric thiocyanate method, by Chapman and Mackay (360-3).

The last method is very sensitive to the presence of air, and minimal results are possible only in purified N with total exclusion of air. For comparative tests this precaution is less necessary. The meeting of the International Committee on Oils and Fats[16] dealt with methods of

sampling and analysis for water and oil in oilseeds; also alkalis and rosin in soap; soluble and insoluble volatile acids and sterols; and determination of thiocyanogen and peroxide numbers in oils and fats.

Iodine value is generally observed to fall during oxidation or polymerisation. Actually this is the net result of a number of reactions, some of which tend to lower i.v. by reacting at the double bond; others tend to raise it. These reactions, which may occur either independently or in chemical sequent, have been briefly reviewed by Gillam.[17]

Oxidation with Neutral Oil

In connection with the formation of oxidised acid in soap-stock, some observed anomalies in the usual method have been noted and discussed by Quelet *et al.*[18] It was found that oxidation proceeds much more rapidly with neutral oil and fatty acids than with soaps. Mucilaginous matter and NaOH in excess have no effect, but various salts are accelerators. Na soaps prepared with ground nut oil previously oxidised to peroxide number above 125 cannot be grained out, but form a jelly which retains all added salt.

In an analytical study of the soap-boiling process, J. Holmberg[19] determined the component fatty acids of soaps from various stages of soap-boiling, in order to study fractionation of individual soaps when the soap mass in the kettle forms separate liquid layers, one of which is of liquid crystal structure. Fractionation occurs both on graining and fitting. Acids up to C_{16} are enriched in lye and nigre. Acids from C_{18} upwards are enriched in the neat.

In analysis, volatile acids are first separated by steam and fractional distillations. The sapon. val. and i.v. were found for each fraction. Non-volatile acids were pre-fractionated by low temperature fractional crystallisation from ether and acetone. Analytical data have been tabulated, including component acids of soaps in various stages.

The first of a series of studies of soap solutions by Stainsby and Alexander[20] dealt with fatty acid soaps and their hydrolysis in aqueous solutions. Hydrolysis is discussed on the assumption that mixed micelle formation occurs between fatty acid moles—formed by hydrolysis—and soap ions. The main features of hydrolysis curves of Powney and Jordan from *pH* measurements are quantitatively established.

The way in which soap or soap solutions act, or the general problems of detergency, have continued to stimulate much interesting research, especially in the context of surface active agents and the like.

There has been a constant flow of papers and patents on surface active agents, in which the leading Swiss chemical firms occupy an important position, especially in connection with textile preparations. The comprehensive volume on the subject by Schwarz and Perry[22] is one of the more important contributions during the past year.

Some interesting sea-water detergency experiments by the U.S. Army have been recounted by T. H. Vaughn *et al.*[23] 160 products were tested and the effects of concentration, *p*H, temperatures were studied for four of the most promising: Na salt of f.a. sulphonated amide, poly-alkyl ether condensate of fat acids, and alkyl aryl poly-ether alcohol, and poly-ethylene oxide derivative of sorbital mono-oleate. Optimum concentration was 0.5 per cent and temperature 120-140° F. All four appeared to give equally good results in large-scale laundry tests with sea-water.

Trinidad Oil

Following other oil companies, Trinidad Leaseholds, Ltd. is collaborating with Universal Oil Products, of Chicago, in manufacturing chemicals and other products from Trinidad oil, including a hydrocarbon oil which can be converted into a soapless detergent.[24] Favourable contracts are said to have been made with soap-makers. A large number of patents, English and American, have been published, many of them, as would be expected, dealing with the alkyl aryl compounds in some form or other.

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POWDER METALLURGY PROGRESS

Titanium a Possible Successor to Aluminium

by R. A. HETZIG

IN the absence of official statistics, it is impossible to indicate any trends in the manufacture and consumption of metal powders from one year to the other. The position is different only in the United States, where the Metal Powder Association publishes figures, confidential to its members, of the quantities of powders used monthly for specific purposes, but no such data are available from any other major industrial country.

In fact, although the powder metallurgy industry in Great Britain, Sweden and France is by no means negligible, a careful scrutiny of the year's literature reveals only three significant figures. The first is that Ford turns out in America 1 million sintered bushings per month[1], the second Chrysler and General Motors between them manufacture some 70 parts for their current automobile production[2], and the third that the Lionel Corporation in the States produces tens of millions of sintered iron top locomotive wheels annually[3].

As these figures are obviously inadequate for estimating the economic significance of the powder metallurgy technique, the only other approach is to balance the encouraging and critical expressions of opinion contained in various authoritative general articles.

Sintered Alloy Steels

Greenwood[4] has summarised the developments that are taking place in the manufacture of small parts from sintered alloy steels. Components mass-produced in this country to-day include rifle magazine catches, hub gears for pedal cycles, pawls, chain bushes, ball-bearing races and die shoes for tangential die heads. Sintered nickel-manganese steels are mentioned in particular, and it is understood that considerable use is made also of surface treatment processes such as cyaniding, chromium-plating, etc.

Bonanno[3], the design engineer of the Lionel Corporation, was especially insistent upon the potential advantages of price between sintered and cast parts, there being practically no scrap losses involved with the former. He also pointed out that the development of a large flake iron powder would help powder metallurgy to enter the field of manufacturing laminated cores for electrical and electronic applications. In his estimation, the market in the United States for such products was of the order of 100,000 tons per annum.

It is, therefore, an interesting coincidence that at this year's Exhibition of the Physical Society a large industrial concern in this country* exhibited various E- and L-pieces made from flake iron powder. The manufacturing process has in the meantime also been patented[5].

Warnings

A note of caution, on the other hand, has been voiced by Clauser[6], whose opinion was supported also by an editorial[7] which stated that "like other new processes, powder metallurgy has sometimes been oversold." Clauser[8] later also published an article on "Structural Parts from Metal Powders," which forms a very sound survey of the manufacturing problems involved.

Ziegfeld and Roll[9], of the Metal Powder Association, New York, warned against indiscriminate application of powder metallurgy, though they certainly also made out a very good case for powder metallurgy where it is really applicable. Perhaps the most objective review of the entire powder metallurgy technique was written by Michel[10], who treated the subject with characteristically French clarity.

In addition to Clauser[8], two other informative articles on the manufacture and design of sintered parts were forthcoming from Engstrand, Gleszer and Polonetz[11], and from Toeplitz[12]. The latter, in particular, dealt with the tolerances of finished metal powder parts.

Carbide cutting tools have attained to such a high degree of perfection that major developments in this field can no longer be expected. Sandford[13] has described the various manufacturing procedures for making tool tips with specified properties, a subject covered only slightly less comprehensively by "Materials and Methods" Manual No. 46[14]. The performance of carbide cutting tools was

* Powder Metallurgy, Ltd.

treated thoroughly in a paper by Eatough and Eckersley[15], and also by Shute[16] in a small brochure on "Cemented Carbide Tools."

The question of particle size measurement of tungsten carbide powder received attention from Burden and Barker[17], who correlated the surface mean diameter of either the original tungsten powder or the tungsten carbide-cobalt powder with the hardness of the finished sintered carbide. They consequently use this method for quality control. Work on the sintering mechanism of hard carbide compositions has been ably summarised by Kieffer[18].

Sintered Wire Advantages

Advances in high-temperature furnace techniques no longer make it essential to treat platinum only by the powder metallurgy method. One important war-time use of this metal was as sparking plug electrodes for aero-engines, and since significant discrepancies appeared in the behaviour of wire made either from cast or from sintered platinum, the problem was investigated by Middleton, Pfeil and Rhodes[19], who found that the porosity in sintered wire was instrumental in maintaining the fibrous structure well above the re-crystallisation temperature of the cast wire. In this particular case, therefore, sintered platinum was obviously to be preferred to the cast metal.

Tungsten filaments for electric lamp manufacture are still, after 40 years, one of the most important applications of the metal. Apart from the BIOS reports on German industry which have appeared in recent years, the subject has been lying dormant for quite a long while. The manufacture of tungsten filaments, in fact, is still one of the most carefully guarded industrial secrets, but in the period under review Smeaton[20] described quite fully the manufacture of tungsten powder from scheelite in a one ton per week plant, omitting only details of the doping of the oxide prior to its reduction to the metal.

Titanium's Future

Newcomers to the metals field are few and far between, but titanium has recently been put forward as a possible successor to aluminium, which acquired the status of a major industry within the last two or three generations. American sources, in particular, have not hesitated to give glowing accounts of its possibilities[21], and the position appears to be that titanium could compete with stainless steel in many applications, though by no means in all[22]. This would ensure for it a reasonably wide and stable market, with concomitant savings in the consumption of chromium and nickel.

Another potentially important outlet for titanium alloys may be as a structural material in aircraft production, since it has a favourable strength/weight ratio with a density intermediate between that of the light metals and steel or copper. Its machining and work-hardening properties are good, but it is extremely sensitive to oxygen and nitrogen, which reduces its ductility and resistance to corrosion.

Titanium can be produced by the iodide process, in which the tetra-iodide is decomposed on a hot filament, or by the Kroll process in which titanium tetrachloride is reduced with magnesium in the vapour phase. The powder may be melted in graphite crucibles and cast, or it may be pressed and hot-rolled in sealed steel containers from which it can be easily removed, any traces of iron in the surface being removed by pickling.

This process of sheath-rolling[23] seems to be the correct method of working titanium powder, because rolled titanium is less porous and less embrittled through the presence of oxygen and nitrogen than compacts that are pressed and sintered in the ordinary way.

Problems to be Solved

A great deal of useful information on cast or sintered Ti metal and alloys may be found in a series of 17 papers that were presented at a Symposium on Titanium[24], sponsored by the U.S. Office of Naval Research in December, 1948. Titanium undoubtedly has a future, but many difficulties remain to be overcome before it can fulfil all the promising expectations that have been raised on its behalf.

Some details of an interesting new device were given in this journal recently[25]. Briefly, the idea is to get a uniform suspension of carbonyl iron powder in a suitable oil, expose it to a magnetic field, and obtain a congealed mass of metal powder that can exert a frictional effect upon the rotating base plates. The magnitude of the frictional effect varies with the strength of the magnetic field, and the practically immediate response obtainable makes the clutch eminently suitable for Servo mechanisms.

The clutch was developed originally for use in an "electronic brain," but it obviously has possibilities in many other directions. The General Electric Co. in America[26] has made experimental clutches with torques ranging from 0.2 in./lb. for tension devices up to 160 in./lb. for testing aircraft engines, although they have

apparently dispensed with the oil suspension in favour of graphite-coated carbonyl iron powder. Several Government agencies and industrial concerns are working on the problem, and one firm[27] has recently put on the market a series of different types of magnetic fluid clutch.

Dust cores have been in use for a good many years now. Their design comes into the province of electrical engineering rather than into that of powder metallurgy, and even their manufacture has recently been claimed by electrical engineers[28] to resemble rather the moulding of plastics than powder metallurgy. However this may be, the fact remains that a whole series of powdered magnetic metals and alloys is listed in the paper just mentioned as core materials for different purposes.

It is necessary to reduce eddy current losses to a minimum in order to obtain the necessary induction efficiencies. While one method is to insulate each magnetic particle with a plastic or ceramic coating, another method would be to take a ceramic material having magnetic properties and obtain low eddy current losses through the high electrical resistance of the material itself.

Properties of Ferrites

Research on these lines was begun by Philips, Eindhoven, in 1933, who found that certain mixed ferrites possessed the required properties. Manganese-zinc ferrite and nickel-zinc ferrite have so far proved to have the most interesting properties, presumably because their molecular structures are so arranged that they form two concentric cubes.

Polder[29], of Eindhoven, recently gave an excellent paper on the theory of ferrites, indicating also reasons for the incompatibility of certain magnetic properties. For instance, it is not possible to obtain simultaneously a high initial permeability and a high frequency-limit. This paper was followed by one by Latimer and MacDonald[30], of Mullard Electronic Products, Ltd., who dealt comprehensively with the application side. These authors also demonstrated the manufacture of Ferroxcube parts, as these materials are called, by means of a film.

Ferroxcube cores have a definite sphere of utility in which they can compete with dust cores, and though they are not a powder metallurgy product, they represent a most interesting border-line case between ceramics and powder metallurgy of which more will undoubtedly be heard.

Another field in which a combination of powder metallurgy and ceramics may have fruitful results is the manufacture of gas turbine blades. Here the object is to obtain minimum creep and minimum oxidation at operating temperatures which are now in the neighbourhood of 1200°C. to 1500°C.

The metallurgist has produced gas turbine blades from special alloys that meet these exacting conditions by using the lost wax process (precision investment casting) or the various machining methods. A considerable amount of work, however, is being done, especially in America, to obtain the same results by pressing and sintering mixtures of metal powders and refractory oxides or carbides, *e.g.*, titanium carbide. All this work is still in the experimental stage. Theoretically these compound materials should have a fairly ideal combined resistance to thermal shock, creep and oxidation.

Cermet Tests

Bobrowsky[31] has collated all published data on the physical properties of ceramals or cermets, as these combinations are variously called, but so far only one report has given any results of operating tests. Hoffman, Ault and Gangler[31] obtained a qualified success with 80/20 titanium carbide-cobalt blades in an experimental gas turbine.

The field of radioactive isotopes in metallurgy is still relatively uncharted, though it may be assumed that much experience with the tracer technique has accumulated during the last few years. An informative article on the subject has been published by Birchenall and Philbrook[32], who mention powder metallurgy incidentally in connection with the measurement of self-diffusion coefficients.

Radioactive Applications

The powder metallurgy method may become extremely valuable in the application of radioactive materials. The United States Radium Corporation has recently filed a patent[33] claiming mixtures of metal powders with radioactive substances for the purpose of obtaining uniform distribution of the latter. Radium needles made of "radioactive stainless steel" are mentioned, as well as a whole series of other possible applications ranging from radioactive sparking plugs and fuses to the sterilisation of milk and telecommunications equipment. This specification contains, in fact, a brief summary of the peace-time uses of atomic energy, apart from its reference to powder metallurgy.

Volume I of a three-volume "Treatise

on Powder Metallurgy" by Goetzel[34] has appeared during the year. It has been favourably reviewed in the technical Press and represents a very sound and up-to-date account of the practical aspects of powder metallurgy. The theories of pressing and sintering are outlined in this first volume, and are to be dealt with more fully in Volume II.

Several interesting papers appeared in the February, 1949, issue of the *Journal of Metals, viz.*, Duwez and Zwell[35] on pressure distribution during the compacting of powders, Kuczynski[36] on the sintering of spherical powder particles to a flat base of the same metal, and Jordan and Duwez[37] on the densification of copper powder compacts sintered in hydrogen and in vacuum.

Recently Shank and Wulff[38] published same work on the distribution of stresses in the die material that occur during the compaction of powder, and emphasised the importance of eliminating elastic deformation of the die which may be the main cause of laminar cracks in pressings.

A three-day symposium on the physics of powder metallurgy was held by the Sylvania Electric Products, Inc., last August. The 23 papers that were presented have been excellently reviewed by Lenel[39].

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Semi-Conducting Materials

RESEARCH workers from Great Britain, the United States, Czechoslovakia, France, the Netherlands, Sweden and Switzerland will contribute papers to a conference on the properties of semi-conducting materials to be held at the University of Reading from July 10-15.

The conference, which is assisted by the United Nations Educational, Scientific and Cultural Organisation, will be under the auspices of the International Union of Physics, in co-operation with the Royal Society.

Prof. N. F. Mott and Prof. R. W. Ditchburn will be organisers and subjects for discussion will include the conductive properties of non-metallic solids, photo-conduction, barrier-layer rectifiers, crystal triodes and the relevant theoretical issues.

The Year's Steel

OVER 2 million tons of steel ingots and 1,135,551 tons of pig-iron and ferro alloys were produced in 1949 by the United Steel Companies, Ltd. These figures and those released by the main steel making firms, suggest that the industry's higher target—15.5 million tons—has been passed.

Producers have now asked the Government to scrap its compulsory distribution scheme, on the grounds that it is out of date and no longer necessary.

The opinion of the Economic Commission for Europe—that the world may have an economic surplus of steel by 1953—is not shared by the Government, which has agreed to the industry's plan to produce 18 million tons by that date. It has been estimated that about 14.5 million tons of this will be required for use in the United Kingdom.

ELECTROPLATING AND ELECTROPOLISHING

Some Details of the Year's Research

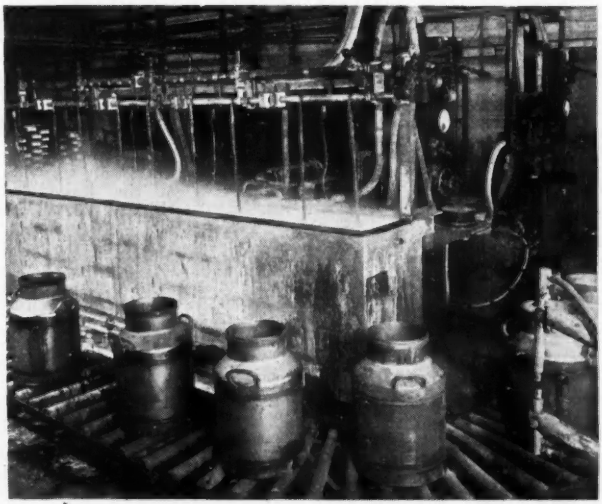
AMONG those contributing to the theory of electro-deposition and electro-chemical phenomena generally in recent years, Prof. Piontelli, of Milan University, occupies a high position. Although much of the work herein briefly noted is prior to 1949, an English version of some of it has just been published (*Metallurgia*, 1949, *41*, 22-25, November). It comprises the general electro-chemical behaviour of metals, electro-deposition of alloys, auto-displacement of lead, and, more specifically, classification of metals according to electro-motive properties, relation between inertia and anodic passivity, and action in concentration cells.

The treatment of electro-deposition of alloys is mathematical and, in places, a little obscure. Part of this subject was dealt with in the paper by Piontelli at the 3rd International Electro-deposition Conference, in London. As the author says, without adequate theoretical basis the study of many complex phenomena of electro-deposition is liable to shipwreck on the rocks of empiricism.

It is, however, difficult to say how substantial are the contributions made to theory this year. Study of the *Trans. Far. Soc.* reveals wide and varied research over a vast field, but not much of direct interest in the present theme.

Hoar's paper on breakdown and repair of oxide films on iron should be mentioned (*ibid.*, 45, 683-693). It is, in any case, an important addition to corrosion theory. The mechanism of this breakdown and repair is examined with special reference to the influence of film rupturing anions (chloride and perchlorate) and repair anions (carbonate, nitrite, and chromate) on the behaviour of iron. Reasons are given for believing that the pores in the oxide films that are potential points of corrosion are easily penetrated by all common anions.

Although the Electrochemical Society, U.S.A., has been largely pre-occupied during the year with the preparation and properties of phosphors (for luminescence, etc.), several papers of interest, theoretical and practical, in the electroplating and kindred sections have been published. A good example is that by Wadsley and Walkley on MnO$_2$ potential (*Jnl. E.S.*, 1949, *95*, 11-20). (*continued overleaf*)



Plant at the Tin Research Institute, Greenford, Middlesex, used for the electrolytic degreasing of steel milk cans prior to pickling and tinning

(Courtesy of Clare's Services

The potential of the system, Pt or C, $MnO_2/MnCl_2$, HCl, AgCl/Ag, was determined to obtain standard potential of the MnO_2-manganous ion couple in acid solution. Attempts are made to explain, on the basis of the experiments, conflicting evidence of previous workers.

Other papers are: the electro-deposition behaviour of simple ions, and application of the Nernst equations (*ibid.*, 25-32); rate of solution of highest purity Al in NaOH solutions (*ibid.*, 98-106).

Natural Convections

A paper by Wagner deals with the rôle of natural convections in electrolytic processes. At a vertical electrode, well defined convective flow, due to generally smaller density in the boundary layer and resulting buoyancy force, exists. It is analogous to natural convection in heat transfer from radiators. The interplay between diffusion and convective flow determines the limiting c.d. (current density) when such voltage is applied that concentration of one of the reactants at electrode drops to zero.

In Germany, H. Lux has continued his researches on reactions in melts, namely: 4. equilibrium system—alkali oxide/*m*-phosphate/*o*-phosphate; 5. solubility of CaO; and 6. equilibrium in system—Na_2O-TiO_2. (*Zt. f. Elektrochem.*, 1949, *53* (1), 41-48) Schwabe has reported on the use of the bismuth electrode (*ibid.*, 125-132). Bismuth electrodes prepared in various ways for use in *p*H measurements were compared with the usual type, and gave results in good agreement. They offered certain advantages in the alkali range.

Some work has been done by Raub *et al.* on the electrolytic separation of Ag from K and Na silver cyanide solutions, also those containing $CuSO_4$ or $AgNO_3$ to which organic oxyacids and the like have been added.

In Russia, some experimental work by Z. A. Iofa *et al.* has recently been published (*Zhurn. Priklad. Khim.*, 1949, *22* (9), 983-994), dealing with reactions occurring at the zinc electrode of an alkaline (electrolyte) cell. It was carried out in the electrochemical department of the Moscow University, and included a study of equilibrium in the system ZnO—KOH—H_2O and the changes in structure and properties of the deposits, ageing, passivation and its effects, together with the relation between potential and c.d. during passivation and activation (depassivation) of the zinc anode in caustic potash solution.

It was shown that the loose friable deposits easily removed from the electrode do not inhibit anodic solution, and that there is some relation between the changing form of deposit separating out in the electrolyte and the structure of the electrode deposit.

In every ease, whenever the rhombic hydroxide is precipitated or deposited, the zinc electrode invariably becomes passive at the beginning of the secondary working period of the cell, and the cell ceases to function. This rhombic form is stable in strong caustic potash solutions at low temperatures, and in medium strength solutions at room temperature. At the latter, with strong solutions, the stable and in equilibrium zinc oxide appears without formation of dense films or flake impermeable to the current, so that the cell can function without passivation during its secondary stage.

Moreover, the cell can work uninterruptedly in that stage in medium concentrations only at temperatures of zero or below, since, in these conditions, there is primarily a deposition of prismatic and acicular forms of hydroxide which do not produce an adhesive film.

Corrosion research at the Department of Scientific and Industrial Research laboratories described during open days (June 28-July 1, 1949), is of wide general interest. Probably the most interesting from the electroplating point of view was the demonstration of chromatographic analysis, which has been successfully developed. Separations are carried out with organic solvents and solid adsorbents, *e.g.*, cellulose in the form of strips or sheets of adsorbent paper or as pulp packed in tubes. In this connection reference should be made to the general discussion on chromatographic analysis by the Faraday Society on September 22-24.

Passivity

Unified mechanism of passivation and inhibition was described by R. B. Mears, of the Research Laboratory, Carnegie-Illinois Corporation (*Jnl. Electro-chem. Soc.*, 1949, *95*, 1-10). Such mechanism is based on the behaviour of local elements in the metal surfaces. It is suggested that passivity may be attained by (a) reduction of open circuit potential differences between local anodes and cathodes; (b) increased anodic polarisation; (c) increased cathodic polarisation; or (d) combinations of these.

Electrophoresis is described by A. H. Stuart (*Electroplat.*, 1949, 513-8), using colloidal solutions and emulsions.

The Electrodepositors' Technical Society continues to provide a wealth of practical materjal in its journal. It was revealed

that the very successful 3rd International Organisation had cost the society £381, and this by no means extravagant figure was rightly regarded as a long-term investment.* The comparatively new journal *Electroplating*, in its enlarged form, is further extending its sphere of usefulness; the present review is much indebted to it. (References hereafter under *El.*).

In the U.S.A. also the industry has continued its growth. That is evidenced by figures of large increases in power requirements, published in *J. Electrochem. Soc.* Between 1929 and 1943 the power used in what are called the natural electro process industries increased from 9 to 38 billion kWh, and use by electric furnace alloys in 1943 was 5.25 billion.

The American journal *Plating* in 1949 also contained much of practical interest, including a long series of articles on the determination of impurities in electroplating solutions, and another on porosity of coatings. Other articles dealt with the chemistry of the CuZn alloy plating baths, and electrolytic tin-plating.

The estimation of Co in bright Ni plating solutions, applying the method of Dickens and Massen for estimation of Co in steel, is described by Carter (*J. Electrodep. Tech. Soc.*, 1949, *24*, 27-31). A strongly ammoniacal solution of a Co salt is titrated with K ferricyanide, and the end point potentiometrically determined. The EFCO-Udylite bright nickel solution, produced by the Electrochemical Engineering Co., Weybridge, offers many advantages, using an organic brightener, and having a throwing power said to be equal to that of other bright nickel agents (*El.*, 1949, *2*, 92-4).

Black Nickel Plating

Defects and their remedies in black nickel plating solutions are discussed (*ibid.*, 249-252); and what is modestly claimed to be a simple exposition of nickel plating for the less advanced reader is given by R. L. Buckley (*ibid.*, July). The Mond Nickel Co., Ltd., has several patents for nickel plating: deposition on Zn, EP 615,036; Ni on Ni, EP 617,689, 618,322; anode assembly for Ni plating EP 613,244. The Harshaw Chemical Co. has EP 622,761, for bright and semi-bright Ni plating.

Electroplating data sheet No. 1 (*El.*, 1949, *3*, 9-13) provides a comprehensive list of addition agents for zinc plating solutions, mostly brighteners. The first publication of the Hot Dip Galvanising Association, affiliated to the Zinc Development Association, relates generally to hot dip galvanising and rust prevention. Among patents are EP 614,847, of E. I. Du Pont de Nemours, for new foaming galvanising fluxes; and U.S.P. 2,479,670 (Chester). for deposition of Zn. The converse process, that of plating zinc itself, is described, with special reference to the Despo method for zinc and zinc alloys (*El.* 1949, *3*, 54-56). The chemistry of CuZn alloy plating baths has already been noted.

Tin Reducing Plant

It is claimed that the electrolytic tin-plating plant of the Republic Steel Corporation, U.S.A., which has taken the place of the hot dip pots, has considerably reduced the amount of tin required per unit area, effecting a saving of 0.5 to 1.5 lb. per 217 sq. ft. As the new plant has a working speed of 500 ft./min., this could effect a saving of 750 tons per annum. The electrolytic plant is 540 ft. long and has a normal production capacity of 1.8 million base boxes per annum (*El.*, 1949, *3*, 83-88).

A high efficiency anode for alkaline tin-plating is described by Lowenheim (*Jnl Electro.-Chem. Soc.*, 1949, *96* (4), 214-225). By incorporating up to about 1 per cent Al in the tin anodes c.d. can be markedly increased. This proved to be the best out of about 26 elements tried, and may be used with both K and Na stannate baths.

"Electrolytic Tinplating" (*Plating*, 1949, *36*, 1233—Dec.) is another useful contribution on that theme. CuSn plating with insoluble anodes is the subject of EP 621217, by the Thermit Corporation, U.S.A.

Silver as raw material in electroplating was described by H. G. Dale, of the Sheffield Smelting Co., Ltd. (*El.* 1949, *3*, Oct.). Among the patents is that of the Ministry of Supply (EP 615,925) for silver coatings on metals. Though not strictly concerned with plating, the paper by Griess and Rogers, on electro-separation of traces of Ag from Pd., may be noted here (*J. Electrochem. Soc.* 1949, *95* (3), 129-144). A method for high speed semi-bright silverplating is described in EP 617,786, by Standard Telephones & Cables, Ltd.

Some practical defects in chromium and their remedies are discussed (*El.* 1949, *2*, 6-11); also wear resistance of hard chromium deposits and recent German practice (*Ibid.* 543-4). Proceedings at the annual conference on hard chromium, at the Maison de la Chimie, Paris, are reported (*Galvano*, 1949, *18*, (148), 27).

* A series of lectures on metal finishing at the headquarters of the society, Northampton Polytechnic, London, commencing January 11, 1950, has just been announced.

The date was May 20, 1949, and papers included: development of industrial applications of chromium plating in France, by de Buyer; magnetic control of coating thickness, by Brachet; applications to textile and glass industries; modern hard chromium plant, etc. An editorial note on the conference is by no means flattering. A more laudatory tone is sounded in an English review of the book (in French) on hard chromium plating, by Paul Morisset, director of the Centre d'Information du Chrom Dur, 1948, (*El.* 1949, *2*, 328).

Unsuitability of Tantalum

Tantalum again appears somewhat intractable as a coating. Seim and Holt report (*J. Electrochem. Soc.* 1949, *96* (1) 43-47) that the methods recorded in the literature have been tried by them, as well as methods of their own, but all were unsuccessful. This appears to apply also to Ta alloys. Fused baths, however, were not tried.

The electrodeposition of molybdenum from aqueous solutions has been described by Kayeki and Yntema (*J. Electrochem. Soc.* 1949, *96* (1), 48-56). Aqueous solutions of molybdic acids were used, containing high concentrations of salts: formates, acetates, fluorides, and alkaline phosphates. Optimum conditions are indicated: *p*H 5.5-6.8, c.d. 0.06-3.3 amp./cm^2, temp. 30-55° C., using Cu, Ni, or Fe cathodes and Pt or C anodes. Other metals, Fe, Ni, Co, may be co-deposited.

The same authors have also studied deposition of Mo alloys (*ibid. 96* (4) 205-213), in a new aqueous citrate bath containing the sulphate. There is co-deposition of Mo, citric acid, and Na molybdate.

Electro-deposition of germanium with aqueous, non-aqueous, and fused electrolytes has been studied by Colin G. Fink *et al* (*J. Electrochem. Soc.* 1949, *95* (2), 80-97). When aqueous electrolyte is used, the effect is limited, apparently owing to very low hydrogen over-voltage. With alkaline solutions it was possible to co-deposit other metals, such as an alloy of Cu-Ge. The chemical resistance of this is high and the coating should have good protective as well as decorative value. The fused method was also described.

Beatson has treated the difficult problems of welding, brazing, and soldering coated metals in a comprehensive paper that evoked much discussion (*J. Electrodep. Tech. Soc.* 1949, *24*, 41-56). The most suitable coating for soldering steel or non-ferrous metals is tin. Among protective coatings for steel, the relatively new SnZn plating appears to be most easily soldered. In brazed assemblies it is preferable to plate after brazing, though several platings can be satisfactorily brazed. In the case of resistance welding, and more especially spot welding, several coatings are satisfactory.

Hill described the practical aspects of plating in the spoon and fork trade (*ibid.* 57-78); and Upton discussed its applications in the printing industry (*ibid.* 95-110).

On the important subject of tank linings and insulating materials, exposed to corrosive action of solutions, Evans gave much practical information (*ibid.* 129-146). He reviewed the principal materials used, including some that are relatively new. An all-purpose material, usable in all cases, has not yet been discovered.

The blistering of electro-deposits on Zn alloy die castings has been investigated by Wernick *et al.* (*ibid.* 195-210, 217-220). Many of the more serious defects of the past have been removed by advances made during the last decade, yet there is one difficulty still persisting, namely blistering. Methods for dealing with this successfully are described. Briefly, they consist mainly in careful storage under non-corrosive conditions, and protecting the castings between the as-cast or polished condition and actual plating. They should be plated as soon as possible after casting. The preparation of specimens for micro-examination is described.

K. E. Langford continued his series of articles on solutions (*El* 1949, 89-91, etc.); and Colgate another series on purification (221-8, etc.). The porosity of metal coatings was the subject of a paper by Pearson, of BISRA, read before the ETS on January 17; (see also *El.* 1949, 102-6). It was mainly a preliminary survey, as the work was by no means completed at that time. A. G. Sussex, in a contribution to a symposium in Australia, described electroplated coatings for corrosion protection (*El* 1949, *3*, 97-99.)

Patents

Among the numerous patents may be noted those of: British Thomson-Houston Co., Ltd., EP 615,110, for improvements in cleaning and electroplating processes; Westinghouse Electric International Co., EP 29242/1948 (open to public inspection) for electroplating apparatus; Etat Français, EP 4307/49 (o.p.i.) for surface superfinishing; Wilson & Ellis, USP 2,471,918, for electrodeposition of Cu; Max, USP 2,475,974 and 2,482,354, for electrodeposition of Cu; McCoy, USP 2,473,163, okating Ni on Al; Liger, USP 2,474,092, for electrodeposition of Pb; and Matson *et al*, USP 2,480,156, electrodeposition of iron.

Aluminium, magnesium, and their alloys occupy a special position in regard to surfacing, both on account of their importance and of the methods used. A very large amount of work continues, and only a small part can here be noted. Anodic oxide coating on Al has been described by Bradshaw *et al* (*J. Electrodep. Tech.* 1949, *24*, 147-170). Results were presented on anodising according to DTD Specification 910, with special reference to weight of coating, attack on metal, density and micro-porosity, and stress of formation. Some results obtained by the chemical MBV process are also given.

At the first National Exhibition of Industrial Finishing, 1949, were shown chemical and electrolytic finishes on aluminium, including some of the colouring effects—the subject of numerous patents and papers.

The deposition of metals on Al was described by S. Heiman (*J. Elect.-Chem. Soc.* 1949, *95* (5), 205-225), as well as a new process for depositing Zn, Cd, Sn, by chemical displacement. The immersion solutions used contained the metal sulphate and either HF or the fluoride anion. Very satisfactory results were claimed.

In addition to Bradshaw's above-mentioned paper, one by Bradshaw and Clark was also read to the ETS (May 16), on the anode film and its formation, (*El.* 1949, *2*, Sup. 491-5); and one by N. D. Pullen on anodising Al wire and strip (*ibid.* *3*, 3-8).

Among the very numerous patents may be noted those of: The Aluminium Corporation of America, EP Nos. 614,671, 621,874, for oxide coatings on Al; Cie. du Prod. Chim. et Metallurg, etc., EP 606,240, for treatment of Al surfaces; de Long, USP 2,474,181, for anodic coating on magnesium.

A Work on Polishing

It had been hoped that the second volume of Jacquet's outstanding work on the subject of electrolytic polishing would have been available before these notes were compiled—dealing with metals other than Al, Mg, and their alloys—but such is not the case. The first volume, published in 1948, dealt very fully with the light metals and alloys, but rather from the point of view of metallurgical research, e.g., micro-metallurgy, than that of industrial applications, although Jacquet's first researches were in this latter direction.

The electrolytic polishing of brass pressings was the subject of an interesting paper by P. Berger (Wm. Bate, Ltd., Walsall) at a meeting of the ETS. For articles such as cruet tops and the like this method offers the advantages of combined *o*-phosphoric acid and acid chromate solutions. The description of the mechanism indicates that the c.d. was 200-1200 amp./sq. ft. and temperature 40-50° C. If polishing is to be followed by plating passivity must be removed, especially that due to Pb compounds; (see also EP No. 603,545).

Electrolytic polishing in cyanide solutions is dealt with (*El.* 1949, *3*, 48-51), and electrolytic polishing of Ni in U.S.A. (*ibid.* *2*, 253-6). Surface preparation by electrolytic polishing is discussed by C. L. Faust (*J. Electrochem. Soc.* 1949, *95* (3), 62C-72C).

Among the patents are: K. T. Grubb, EP 604,056, electrolytic polishing; Aluminium Corporation of America, EP 613,487, electropolishing of aluminium; Westinghouse Electric International Co., EP 617,476, electropolishing silver by periodic current reverse; P. A. Charlesworth, EP 622,118, electrolytic polishing of stainless steel and nickel; Turner, USP 2,473,923, electrolytic polishing; J. F. Gall *et al* USP 2,481,306, electrochemical polishing of tantalum.

Barrel Methods

The old barrel plating and polishing methods are by no means extinct. They found, indeed, a staunch champion in, among other authorities, Dr. A. W. Wallbanks, president of the ETS, in a paper read to that society (*J. Electrodep. Tech. Soc.* 1949, *24*, 181-193, 213-6, "Barrel-plating to Specification.")

Although much barrel plating to-day is still old-fashioned, producing indifferent results, yet, with intelligent design of plant and lay-out, operation, and control, it can still prove a competitive method over a wide range. The paper evoked much keen and interesting discussion.

Another paper on this subject was that of Weiss (*ibid.* 171-180, 211-220), who described methods of deburring and polishing in barrels. These are of more general application than is commonly supposed, not limited to small articles. There was even more keen discussion here.

Recent developments in low tension power supply have been described by Ashby (*J. Electrodep. Tech. Soc.* 1949, *24*, 79-90), including improvements in oil-cooled selenium rectifiers in which there is no limit to the current: the higher the current the greater the advantages of the rectifier. Among important improvements is automatic control for operating at constant c.d. irrespective of area of work.

Automatic control has also been introduced in connection with chromic acid anodising. Plants have been running quite satisfactorily, as stated by Wernick and Willett at the 3rd International Confer-

ence. It is important to note that c.d. must be such that minimum thickness is used, although closer control is now possible with the improved system. Great Britain is now probably ahead of the U.S.A. in this field.

Statistical Quality Control

Some recent patents include: Westinghouse Brake & Signal Co., Ltd., EP 23695/48, (open to public inspection), for improved rectifier circuits; Martinet *et al*, USP 2,476,989, for selenium rectifiers; Wilson, USP 2,479,446, ditto; USP 2,477,364, for blocking layer rectifiers; Blackburn *et al*, USP 2,479,301, for selenium rectifiers; Driver, US 2,480,124, and Goodman, USP 2,481,739.

G. F. Mortimer Young has dealt comprehensively with statistical quality control, (*El.* 1949, *2*, 229-242). The paper was read before the Institution of Engineering Inspection. The methods are based on modern statistical theory and practice for the control of the whole series of operations from the inspection point of view, and deal mainly with the plating department.

Temperature control of steam-heated plating plants was discussed by the technical staff of Sarco Thermostats, Ltd. Thermostatic control systems have now become a common feature in process equipment. Automatic temperature control in vats and tanks not only saves fuel but necessarily improves quality, especially with chromium plating (*El.* 1949, *2*, 377-385).

Control systems for electrolytic processes are the subject of USP 2,471,912 and 2,473,918, in the name of Stoltz and Erbe. An apparatus for indicating degree of finish is claimed in EP 614,240, by J. R. Cornelius.

At the various trade and industrial exhibitions held in 1949 the electrochemical industries have been well represented in all their different branches, especially at the BIF, Birmingham section. At the first National Exhibition of Industrial Finishing, at Earls Court (August 31-September 13), a very good beginning was made, all kinds of finishes being shown.

More Mechanisation

A definite advance in mechanisation was demonstrated by the Roto-dip and spray plant at the Morris Cowley works, this being similar to the one at the Birmingham works of Fisher & Ludlow, Ltd. (*El.* 1949, *2*, 533-9; *3*, 18-20). This combines cleaning, phosphating, and primer painting in the one plant, in which the Carrier Engineering Co., the Pyrene Co., Docker Bros., Ltd., and I.C.I. (Paints), Ltd., have collaborated.

Stress-Corrosion Cracking: Tests on Welded Steel

INTERGRANULAR cracking occurring in welded mild steel gas mains carrying crude coke oven gas is associated with the factors normally causing stress-corrosion cracking in other alloys.

A study of the problem using a calcium-ammonium nitrate solution as the corroding liquid is contained in the December issue of the welding research supplement to the transactions of the Institute of Welding.

The report shows that mild steels differ in their susceptibility towards this type of failure according to their composition, provided tensile stresses of sufficient magnitude are present.

Parallel tests in a coking plant and in the laboratory using the above solution indicate a broad correlation between the failures occurring under the two different corroding conditions. Study of the problem in the laboratory and design of a further field test are considered justified.

In addition to the influence of composition and mode of manufacture of the steel and the effect of various stresses, it is apparent that cold working considerably impairs the resistance of steels to this form of failure and also that the phenomenon is amenable to anodic or cathodic control.

The part played by tensile stresses in the occurrence of these failures suggests that the alteration of the stress system in structures subjected to the corrosive conditions likely to cause this type of failure should form a practicable method of combating the problem.

In this respect, annealing at temperatures of the order of 300-400°C. suffices in rendering welded steel structures safe from stress-corrosion cracking in the calcium-ammonium nitrate solution, although the possibility that some mechanism other than stress relief is operative in bringing this about is not excluded.

Hammer and shot peening after welding have the same beneficial effect.

The Ruhr's Steel

German economic officials claim that the Ruhr district produced in 1949, 9,026,000 tons of steel, an increase of 3,626,000 tons over 1948. Production is still rising.

LEGISLATION AND CHEMICAL INDUSTRY

Some Changes During 1949

THE most important legislation in 1949, from the point of view of the chemical industry, has been the Patents and Designs Act and associated Patents Act and Registration of Designs Act. The two latter are purely consolidating Acts and, apart from observing that the treatment of patents and of designs is now in separate statutes, call for no comment.

The amending Patents and Designs Act completed the work proposed by the Swan Committee. It is a substantial measure of 53 sections, of which only those making considerable change in procedure can be considered now. An application for a patent may now be made by the person to whom the inventor has assigned his rights. The complete specification filed in pursuance of an application for a patent must disclose the best method known to the applicant of performing the invention. The rules affecting priority dates are altered to enable an inventor making application for protection in a "Convention country" to claim priority from the date of his application. But, to ensure this, the applicant must claim protection in this country within 12 months of his application in a Convention country.

Protection of Patents

New powers conferred on the Comptroller permit him, if he thinks a process for which an application has been made cannot be performed without substantial risk of infringement of another patent, to direct that a reference to the other patent be made in the application—by way of notice to the public. Additional grounds of opposition to a grant are that the invention was used in the U.K. before the priority date of the claim or that the invention is obvious and does not involve any inventive step, having regard to matter published in the U.K. before the priority date. The grounds on which a patent may be revoked by the Court have been completely rephrased.

Sections 15-24 cover ground that is largely new and deal with abuse and insufficient use of patent rights. At any time within three years of the sealing of a patent an interested person may apply to the Comptroller that the patent be endorsed "licences as of right" so that he will be able to make use of the process. The grounds on which the Comptroller make take this step are:—

(1) that the invention is capable of being worked in the U.K. and is not being commercially worked or is not being worked to the fullest practicable extent.

(2) that a demand for the patented article in the U.K. is not being met on reasonable terms or is being met to a substantial extent by imports.

(3) that the commercial working of the invention in the U.K. is being prevented or hindered by imports of the patented article.

(4) that because of the refusal of the patentee to grant licences on reasonable terms an export market is not being supplied, or the use of another patent is hindered, or the commercial or industrial activity of the U.K. is unfairly prejudiced.

If the applicant makes out his case the Comptroller may also grant licences to customers of the applicant on the terms he thinks fit.

The purpose of this new provision, as the wording of the Act discloses, is to ensure that the economic welfare of the whole community shall predominate. Section 16 instructs the Comptroller to exercise his power with a view to securing that inventions which can be worked on a commercial scale in the public interest should be so worked with the least delay and to the fullest extent; that the inventor or owner of the patent should be reasonably remunerated; that the interests of any person for the time being working or developing an invention should not be unfairly prejudiced.

Many Considerations

He must also take account of the nature of the invention, the time which has elapsed since the sealing of the patent and the measures already taken to make use of it; the ability of the person to whom a licence would be granted to work it to the public advantage; the risks which that person would have to undertake in providing capital.

Two years after Endorsing the patent on these grounds, the Comptroller may revoke the patent if there is a further application.

A government department may apply for a patent to be so endorsed. Wide powers are also vested in the government to use a patented invention for the ser-

vices of the Crown. During emergencies the powers are even wider and correspond to the purposes for which Defence Regulations were permitted during the war. There are detailed provisions to preserve the secrecy of patents used for defence purposes and, to safeguard the inventor, the Government must give an account of use made of patented processes.

An attempt has also been made to reduce the high cost of litigation. Rules of Court are to be made to enable scientific advisers to sit with the Judge. All disputes as to infringement may now by consent be referred to the Comptroller. He may be asked to make a declaration as to the future, that a process would or would not constitute an infringement of a patent. An additional Judge of the High Court is to be appointed to specialise in patent matters.

A special section deals with claims for patents for chemical substances. Where a complete specification includes a claim for a substance, the claim will not be invalid on the sole ground that it is not limited to the substance when produced by specified methods. The Comptroller may refuse an application if he thinks that it claims as an invention a substance capable of being used as food or medicine which is a mixture of known ingredients possessing only the aggregate of the known properties of the ingredients or that the substance is produced by mere admixture.

Export Promotion

The objective of the Export Guarantees Act is to encourage trade with places outside the U.K. The Board of Trade, after consultation with the Export Guarantees Advisory Council and the Treasury, will be empowered to make arrangements for guarantees. These may be given for the benefit of persons carrying on business in the U.K. They must be in connection with the export, manufacture, treatment or distribution of goods, the rendering of service or any other matter which appears to the Board of Trade to promote the success of the export drive.

Statutory Instruments

The usual enormous range of subjects was dealt with by Statutory Instrument. Several of them were of major importance to the chemical industry. Perhaps the most important, relating to "Alkali Works" is still in draft form. Under the Alkali Works Regulation Act, 1906, the discharge of certain noxious or offensive gases from specified works was subjected to control. The draft Order adds the following gases to the list already dealt with—volatile organic sulphur compounds, fumes containing carbonaceous particles from black production works and fluorine.

The following classes of factories are brought within the Act: black production works, acid sludge works, fluorine works. The Act is also extended to include certain additional processes carried on in sulphuric acid works, chemical manure works, bisulphite works and cement production plants.

Rationing Relaxed

A number of rationing orders have been relaxed or abolished. By S.I.98 the orders controlling the production, distribution, acquisition and disposal of chemical fertilisers has been revoked. But price control remains, as is shown by SI1136. This alters the analysis of the fertiliser known as National Compound No. 2 and increases the price. The formula is altered to require the contents to be: Soluble P_2O_5 6.5 per cent; insoluble P_2O_5 0.5 per cent; K_2O 7 per cent.

SI 549, which dealt with molasses and industrial alcohol, provided that urea is no longer to be a controlled material. It also increased the prices of food for stock molasses. This was followed by SI 1001 which superseded the Molasses and Industrial Alcohol Order 1946. The control now applies only to molasses. Undenatured alcohol, acetic acid, acetic anhydride and butyl alcohol are decontrolled.

The maximum prices for ground sulphur were reduced by SI 1027. The production, disposal, use and consumption of sulphuric acid was decontrolled by SI 1934. Maximum prices for producers remain and are to be based on the prices charged them in the period April 1 to June 30, 1949.

The Control of Employment Act 1939 ceased to be effective from May 31, 1949.

The Development of Inventions Act was mentioned in THE CHEMICAL AGE at the beginning of the year. Regulations have now been issued under the Act dealing with the constitution of and qualifications for the National Research Development Corporation; the tenure and vacation of office by its members; the methods of entering into contracts and doing business and the observance of legal formalities by the Corporation.

Section 26 (1) of the Factories Act 1937 requires the employer to provide safe means of access to every place at any time. It has now been decided that the duty laid upon the factory occupier is not confined to his employees, but to any other person working upon the premises.

GERMAN RECOVERY

Heightening Resistance to Controls in 1949

NO period since the war has witnessed such profound changes as 1949 has produced in the capacity and prospects of German chemical industry. An incidental reflection of this new stature may be seen in the December special issue of *Chemische Industrie* in which nearly 100 editorial pages are employed to survey the present state of the industry and some imminent prospects.

The writer of the introductory article, reviewing some of Germany's past achievements in the chemical field, characteristically denies there is any foundation for the charge that German chemical industries were interested in military intrigue.

This and subsequent articles contribute one of the most comprehensive reviews of work and events in German chemical affairs during the past four years. Strenuous efforts have been made to re-establish such branches of industry as are permissible, but under very great difficulties, of which lack of proper organisation —always a primary requirement of German industry—has been among the most formidable.

Dr. S. Balke, of Munich, describes in detail some of the attempts at reconstruction, in conditions of extreme uncertainty, and presents production figures for the pre-war and post-war periods. The greatest problem is recognised to be to secure increased exports. Despite Allied efforts to improve export prospects, many new difficulties have arisen. These include the "liberalising" of European trade, and obstacles in the way of constructing the German tariff system.

Possible Japanese Dumping

The German writers do not underestimate the possible effects of the clouds arising in the East and the potential threats to the U.S.A. and especially England, and the possibility of Japanese dumping.

Fear of German commercial revival is considered still to be profound, and, in Dr. Balke's opinion, is strengthened by statements of certain German politicians who seek to restore the old "reactionary monopolistic large scale capitalist system." Other difficulties relate to financing, the urgent need of which can not be satisfied by foreign credits only. Any hopes that foreign capital would flow into German industry on a substantial scale are thought to be illusions.

The recent agreement (November 24, 1949) is admitted to have improved the position of German industry in relation to dismantling, and there are brighter hopes that the "Expiation" attitude is going to be less in evidence. The Fischer-Tropsch process is again mentioned. Disputing claims that Germany's production of fuel oil by hydrogenation or otherwise could constitute a menace the writer cites the fact that, at the time of maximum output in the Spring of 1944, that process provided no more than 6.9 million tons, or about 5 per cent of the U.S. programme. Dr. Balke is another of those who plead the great importance of this process in providing synthetic fats, of which Germany is in great need.

Interest in World Economy

At the end of 1949 the prospects of making an effective new start are still obscure. The attempt to establish a European economic bloc is a first step to a free world economy, in which Germany on historic and other grounds should be interested. To achieve this it is essential among other things, says the writer, that present contradictions between Allied theory and practice should be reconciled.

A detailed and critical review of West German chemical imports and of Allied policy and the controls governing them is given by Dr. W. Koeck, of Frankfurt. Chief among the numerous control bodies are the JEIA (Joint Export-Import Agency), the ECA (Economic Control Agency) and the BICO (Bi-partite Control Office). Several others are mentioned. Some import figures (in $ million) are tabulated for the last two quarters of 1948 and first two of 1949, with totals and estimates for 1948-50, Marshall-Plan years. The principal categories are these:

	1948 qtrs.		1949 qtrs.		Marshall Plan Years	
	3rd	4th	1st	2nd	1948-49	1949-50
Vegetable/animal oils and fats	4.5	5.1	10.2	10.6	30.4	28.3
Resins, turpentine oil, gums and waxes	2.5	1.7	3.3	2.3	9.8	13.0
Raw materials (vegetable and animal)	2.2	1.8	4.7	3.2	12.0	12.0
Raw materials (mineral)	2.8	0.3	0.6	2.2	5.9	13.7
Semi- and finished chemical materials	6.6	5.3	7.3	7.2	26.4	25.4

The addition at the beginning of 1949 of one more to the already over numerous control bodies—the Import Advisory Committee—does not appear to have improved matters, and is being held responsible for serious increases in prices of some imports, *e.g.*, 100 per cent for essential oils and agar-agar. It is, in fact, estimated that the total rise in values for 1949 amounted to no less than $55 million, and was particularly severe in the paint and varnish, synthetic resins, sulphuric acid and fertiliser (superphosphate) and other industries, causing substantial increase in prices of finished goods.

Import Free Lists

Still more important changes in the structure of German import trade are taking place under the so-called liberalising of West European commerce, including "free lists" for all participating countries except Switzerland and Belgium (A1), free lists subject to price limits (A2) and conditional free lists (B).

Some details are given of agreements with Switzerland, Netherlands, Austria, Norway. Other agreements are under negotiation with Belgium, Sweden, and France. The writer concludes that the success of this liberalising policy will depend largely on the extent to which other countries follow the German example in respect to free lists. In Germany this comprises about 50 items in the chemical category from which all tariffs have been removed. Meanwhile, ordinary trade agreements have been concluded with 31 countries.

On the export side, the estimated volume of trade for the Marshall Plan year 1952-53 is reckoned at $800-350 million. Pre-war figures are given in considerable detail. For the twelve months ended December, 1948, the total for the bizone was $34,332,000 (Dm.110,064,000); and for the nine months ended September, 1949, it was $51,906,000 (Dm.176.039,000). Some of the principal items for these periods included ($1000):—

	1948	9 months 1949
Tar distillation, products	1,545	490
Calcium chloride, potass. sulphate, etc.	3,057	2,675
Special semi-manufactures	876	3,556
Nitrogen fertilisers	286	195
Plastics	509	663
Coal tar dyes	8,130	12,275
Paints, varnishes, etc.	4,765	7,456
Special chem. products*	8,918	12,610
Oil and fat products, soaps	50	173
Photochemicals	365	699
Pharmaceuticals	3,427	4,543
Special chem. products†	747	2,080

* Primary or intermediate.
† Finished.

The totals for the two periods represent 5.6 per cent and 6.6 per cent respectively of total German exports.

In discussing the present position of Germany's heavy chemical industry, Dr. E. Herzig (Frankfurt/Main-Höchst) takes the usual yardstick as a guide, namely, sulphuric acid production, quoting some pre-war figures for world and principal countries' output. In Germany in 1943 it was 3.28 million metric tons, as compared with 7.9 in the U.S.A. Output in the bizone in 1938 was 1.36 million metric tons, in 1948, 0.76, and in 1949 (estimated) 0.85 The last was just over one-quarter of all-Germany's peak for 1943. Principal fields of use in percentages for 1948 are given for U.S.A. and the bizone:—

	U.S.A. Per Cent	Bizone Per Cent
Fertilisers	36.5	56.0
Misc. chem. industry	20.7	13.4
Mineral oil refining	10.7	1.3
Textiles (art. silk, etc.)	6.5	9.0
Paints and pigments	6.8	1.3
Carbon products	6.5	—
Iron and steel (metal treatment)	5.7	3.3
Other metallurgical uses	3.2	—
Explosives	1.3	—
Organic intermediates and dyes	—	8.8

Home production of pyrites in 1948 was 383,102 tons and 488,800 tons were imported. Output of alkalis (soda and caustic) was severely restricted after the war by lack of power and raw material. Recovery during the past year or two has been substantial: soda output rose from 235,000 tons in 1947 to 356,000 in 1948; and caustic from 90,000 to 152,000 tons, the former nearly reaching and the latter greatly exceeding pre-war figures. During the last three quarters of 1949, production of most heavy chemicals shows an increase over 1948.

French Sulphur

WITH the resumption of normal imports of sulphur from Sicily and the U.S.A., French sulphur mines are reported to be experiencing a serious decline. Two main exploiting groups exist in France: the Sté. Languedocienne de Recherches Minières, which is still actively engaged with the problem of economic improvement of its minerals, and the Sté. des Mines de Soufre d'Apiqui whose production has dropped constantly. In 1949 activity was almost nil and production under 100 tons. While there is no question of the output of French sulphur mines replacing imports, which amount to 200,000 tons annually, it is recognised that this source is of special importance during periods of difficulty in international exchange.

ORGANIC SYNTHESES. Vol. 28. H. R. Snyder, Editor-in-Chief. 1948. New York: John Wiley. London: Chapman & Hall, Ltd. Pp. 121.

The latest annual volume of this invaluable series of "satisfactory methods for the preparation of organic chemicals" maintains the high standard of its predecessors. The editorial board, assisted by 59 contributors, provides detailed, checked recipes, with notes, for the preparation of 37 organic compounds, of which seven are aliphatic, 20 aromatic, two alicyclic, and six heterocyclic. Research interests of recent date are well represented; for example, by Cason's procedure for branched-chain keto-acids, by the procedure of Swern *et al.* for hydroxylation with performic acid, and by preparations of vinyl and styrene derivatives, and of various sulphur compounds. The subject index is cumulative, covering volumes 20 to 28.—R.G.R.B.

THE LIMESTONES OF SCOTLAND. (Special Reports on the Mineral Resources of Great Britain, Vol. XXXV). Pp. 221, 7 plates, 43 text-figures; HMSO, 17s. 6d.

"The Limestones of Scotland" is the result of co-operation between the Geological Survey and the Macaulay Institute for Soil Research, stimulated by urgent needs during the war. All known sources of limestone were brought under review, representative samples were analysed, and the geological occurrence of the more promising deposits was studied with a view to assessing their potentialities. The result is a detailed account of all the significant limestones in Scotland backed by a series of 175 analyses.

The introductory chapters are written to provide an account of limestone and its uses for the non-technical reader; but they also give a summary of the scientific results that have emerged from the study of the great variety of types of limestone to be found in Scotland and a general description of their distribution. The thick Cambro-Ordovician dolomites of the North West Highlands, the crystalline metamorphic Dalradian limestones of the Grampian country, the Carboniferous limestones of the Central Valley, and the shell sands of the Hebrides, each group has its own economic interest and importance. The dolomites of Sutherland, Western Ross and Skye are as yet virtually untouched and constitute a valuable reserve of high-grade magnesian limestone. The more or less altered limestones of Islay, south-west Inverness-shire, central Perthshire and Banffshire are in some cases of sufficient purity to suggest exploitation for chemical manufacturing purposes. The carboniferous limestones of the Central Valley, though seldom exceeding 20 ft. in workable thickness, have been freely quarried for over 200 years. Their main uses are for lime-burning, agricultural ground limestone, flux and cement-making.

The memoir had its source in the series of wartime pamphlets dealing with limestone in Scotland and it supersedes them in most respects. It is freely illustrated with county and locality maps and detailed descriptions of deposits and workings are arranged under county headings.

ANNUAL REPORTS ON THE PROGRESS OF CHEMISTRY FOR 1948. Vol. XLV. 1949. London: The Chemical Society. Pp. 379. 25s.

With this volume the Chemical Society continues its policy of presenting summaries, by experts, of recent progress in selected chemical subjects. The topics here covered are as follows: in physical chemistry, aqueous soap solutions, and kinetics of gas reactions; in inorganic chemistry, reaction induced by ionising radiations, structure of aqueous soap solutions, and kinetics of gas reactions; in inorganic chemistry, a general survey of the groups of elements; in organic chemistry, general methods, homolytic reactions, terpenes, colchicine and related compounds, reactions of organic sulphur compounds, and heterocyclic compounds; in biochemistry, the function of small molecules in biosynthesis, partition chromatography, insulin, and chemotherapeutic approaches to the tuberculosis problem; in analytical chemistry emission spectrography, flame photometry, volumetric analysis, etc.

ANALYSIS OF COAL ASH

New Fuel Research Paper

A RECENTLY published report of the Fuel Research Station, DSIR, "Improved Methods for the Quantitative Analysis of Coal Ash and Coke Ash" (HMSO, 1s.) forms a basis upon which fuel users may build a useful collection of methods of preparing all types of coal ash and its more important constituents.

The preparation of ash for analysis by the "standard" method, using small quantities of coal in thin layers, is retained only for certain special analyses. A simpler and shorter method for the preparation of the bulk sample is described, with instructions for the application of correction factors.

The separation of silica has been simplified and the time of baking reduced. This also has the advantage of making the dried residues more easily soluble.

Barium in Coal

At one time, the occurrence of barium in analytical quantities in coal was considered to be unusual, but its presence in many coals has now been confirmed. A method for the determination of barium has, therefore, been included in the general scheme. During the determination of silica, the presence of barium is easily recognised, and its determination is relatively simple.

The treatment of the iron group has been changed, so that no separations of members of the group are required; iron and titanium are determined separately by specific methods.

The technique for the determination of phosphorus has been completely changed. The new method was devised by the Northern Coke Research Committee, the repeated fusion of the ash with sodium carbonate being avoided.

In the section of the survey paper dealing with the actual analyses, detailed instructions are given on the right-hand pages in a series of numbered paragraphs. On the corresponding left-hand pages are a series of notes to assist the analyst. These include suggestions for apparatus, the reasons for certain steps and general precautions to be observed.

Attached to each copy of the paper is a diagram illustrating the analytical scheme and quoting the appropriate paragraph numbers concerned with each stage of technique.

TRAINING IN MANCHESTER

Part-time Study Needs

MANCHESTER, which is the headquarters of the active and enterprising North Western Branch of the Institution of Chemical Engineers, has been accused of being backward in providing facilities for the part-time teaching of chemistry. This lack—in an area which he describes as "one of the main centres of the chemical and allied industries"—is deplored in a recent letter to the *Manchester Guardian* by R. Barstow, secretary of the north-west area of the Association of Scientific Workers. Many chemical firms in the district are fully prepared to grant time off for study, Mr. Barstow claims, but the lack of suitable courses in Manchester necessitates travel outside the city by students.

Those already in industry are, therefore, denied the opportunity of studying for technical qualifications. Students in the colleges of other local authorities, states the correspondent, work under seriously overcrowded conditions, but in Manchester itself, not even these meagre benefits exist. Emergency measures, such as the taking over of temporary rooms and the use of more part-time lecturers from industry, are recommended.

Atomic Plant Apprenticeships

AN opportunity for boys to make a career in atomic energy applications by qualifying as craft apprentices is offered by the Ministry of Supply.

A five-year apprenticeship for youths of 16 was announced last week by Mr. F. C. Wake, Northern Regional Controller. The course will be at the Atomic Energy Establishment, Windscale Works, Sellafield, and Cumberland boys will have a preference.

Besides learning a basic craft the boys will be instructed in the use of plastics, ferrous and non-ferrous metals and special attention will be given to automatic control equipment. It is hoped later to include a grade of engineering apprentices.

Uranium in Australia

The presence of a field of uranium ore at Rum Jungle, 60 miles south of Darwin, has been confirmed by geologists of the Australian Bureau of Mineral Resources. Further tests are being made and a report is expected soon on the richness and extent of the field. The Premier of South Australia has announced that production of uranium, on a small scale, from local deposits will begin this year.

An Introduction to Colorimetry

Wider Studies of Light and Colour

THE technique of colorimetric analysis is finding a continually increasing number of applications in industry, medicine and agricultural and other sciences. One of the simplest of the methods of determining the presence of specified substances, it attains a high standard of accuracy.

Many excellent technical works have been written on the subject for the use of the scientist or expert, but there are still many unfamiliar with the technique and its possibilities.

A non-technical picture giving an outline of the importance of colour measurement in everyday life has been written in the form of a booklet, "Colour and the Visual Measurement of Colour," by A. J. Fawcett and published by The Tintometer, Ltd., Salisbury (1s. 6d.).

Early Days

After a brief explanation of the fundamentals the author describes the evolution of the colorimeter from the first instrument made from a tea caddy, by Joseph William Lovibond, a Salisbury brewer.

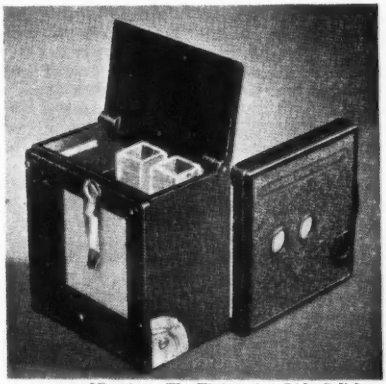
The need for chemical reagents when dealing with substances which naturally are colourless in solution is explained, and it is shown how, when the density of this colour is measured with a pre-determined scale, the concentration of the substance in the solution can be ascertained from the colour reading.

Various types of colorimeter, the Lovibond-Schofield tintometer, the all-purposes comparator, and the B.D.H. Lovibond Nesseleriser (for measuring the colour of very pale solutions), are described.

Detecting Gases

Among the wide variety of relatively simple applications of colorimetry in industry is a portable set for the detection of noxious fumes or gases. The method of calculating the percentage of gas in the atmosphere is by means of an aspirator, which delivers a measured quantity of the air-gas mixture to a chamber which contains either a specially prepared filter paper or a vessel containing a chemical solution through which the air is made to bubble.

The noxious gas is arrested or dissolved and a colour is developed, in one case by a chemical reagent present on the filter paper, and in the other by a chemical reagent in the solution.



[Courtesy, The Tintometer, Ltd., Salisbury

The all-purposes Lovibond comparator, which may be used for measuring the colour of solids by reflected light and for the tests for noxious gases, in which paper filters are employed. Cells of varying optical depth up to 4 cm. may be used

Other varied uses of colour include tests for assaying the *p*H of soil; gaining accurate information as to the chemical and bacterial content of milk; in medicine for testing the percentage of a drug in the blood stream; and in the oil industry in which technologists employ the tintometer for a variety of chemical colour tests.

Colorimetry can be said almost to have created a new industry—the manufacture of the various types of glass cells required to hold the liquids to be measured.

Many factors go to the making of a cell required for use in the measurement of colour. Accuracy of measurement is essential between the two faces of the cell. The glass itself must be of perfect optical quality, without colour or blemish, free from strain and having solid homogeneous joints, so that the cell is proof against chemical attack.

No Licence Required

The commercial drying of vegetables has been released from licensing restrictions from January 8.

Technical Publications

MODERN methods of production and material handling are becoming increasingly mechanised and the continuous conveyor is becoming an integral plant unit. To meet the demand for a continuous automatic conveyor weight totaliser the Adequate weigher, which accurately integrates and records the weight of goods travelling upon a conveyor, has been designed by Adequate Weighers, Ltd., London. The machine is described and illustrated in a pamphlet just issued.

* * *

FREQUENT valve failures have been one of the problems connected with HF preheating equipment. The General Electric Co., Ltd., has sought to overcome this trouble in its new plastic preheater, making use of a single valve oscillatory circuit employing an Osram valve and incorporating a voltage stabilising transformer in the oscillator valve filament supply. In the preheater (described in the company's bulletin Press/J/70) controls have been reduced to a minimum. It is wired for 3-phase, 360/440 volts, 50 c/s supply. The oven will accommodate several pounds of plastic pellets which can be raised to preheating temperature at rates up to 1½ lb. per minute.

* * *

INCREASING needs for a bridge capable of measuring the conductivity of electrolytes at various frequencies in the audio range have resulted in the production by Muirhead & Co., Ltd., Beckenham, Kent, of a new assembly. This is composed of universal units which can be broken down when no longer required. The bridge, fully described in the new bulletin B-648-A, resembles the Wheatstone bridge in circuit, with the addition of a variable capacitance in parallel with the balancing arm to compensate for the capacitance of the electrolytic cell, in which the electrolyte under test is contained.

* * *

THE use of Detel (manufactured by Detel Products, Ltd., Greenford Middlesex) for the protection of fighting vehicles against corrosion is recommended in a report (T.370/412) issued by the Chief Inspector of Fighting Vehicles, Ministry of Supply, Chislehurst, Kent. Tests have shown good results, using Detel as a primer for tank parts, vehicle chassis, and similar parts which are difficult to inhibit during manufacture without considerable pre-cleaning before the application of a priming agent. The treatment has afforded complete protection for a year under tropical conditions.

[Courtesy, R.F.D. Protective Clothing, Ltd.

A new system of ventilation which allows air to circulate freely between the eye-cup and the lens is employed in these industrial goggles—for cooling and to prevent misting-up

* * *

THE compositions and properties of the tin-containing fusible alloys and their more important industrial applications are described in a booklet now available from the Tin Research Institute, Greenford, Middlesex. The booklet, entitled "Fusible Alloys Containing Tin," contains a number of useful reference tables and 15 illustrations.

* * *

HOW necessary it is to reduce titanium production to an economic basis to permit it to become a force in industry is emphasised in "Titanium—Tomorrow's Metal," by W. B. Morrissy in the December issue of the Canadian Industries, Ltd., magazine *The Oval*. Other features include an article on Chemurgy by Philip A. Novikoff and "The Search for Light"—from the wick dipped in oil to the fluorescent lamp—told by Peter Cahn.

* * *

A MULTI-purpose gas-fume respirator of U.S. origin, designed to give protection and working comfort at the same time, has been announced by the Mine Safety Applications Co., Africa (Pty.), Ltd. (P.O.

(continued at foot of next page)

Geological Survey of Northern Rhodesia

£67,600 Grant for First Five Years

FORMING part of an allocation of over £1 million made during 1948-49, under the Colonial Development and Welfare Acts, for the expansion of Colonial geological surveys, a free grant of £67,600 has been approved by the Secretary of State for the Colonies for geological surveying in Northern Rhodesia. This sum is proposed to cover expenditure over a 5 year period and includes a suggested capital outlay of £25,150.

The new survey unit, which is to operate under the Northern Rhodesian scheme drawn up by the Central African Council, will probably have its headquarters at Ndola, in the main prospecting area. Most of the existing geological records are available at the office of the Senior Inspector of Mines in Ndola, within easy access of the Copperbelt, and this should facilitate co-operation with the mining companies.

It is hoped to obtain the services of a geologist and a senior geologist this month (December), and of two more geologists in 1950, reports the Central Office of Information (*Commonwealth Survey*, No. 37), from which source this information is reproduced.

During the last twenty years Northern Rhodesia has developed its copper and cobalt resources until, in recent years, it has become the leading British Colonial producer of these metals.

Copper, which is by far the most valuable mineral mined, remained relatively undeveloped until 1925, when large deposits of copper sulphide ores were discovered at Nchanga and Roan Antelope. Production of the metal has risen from 5930 long tons in 1928 to 213,616 long tons in 1948. All the economic copper deposits being worked are in the Copperbelt, where proved reserves are now about 500 million tons.

In the same period, lead output has increased from 4676 to 13,020 long tons, and zinc from 13,176 to 22,170 long tons. During the period 1930-1947, the total value of mineral production reached nearly £176¾ million; the value in the single year 1948 totalled £23½ million.

There have been three major developments, within the past 20 years, at the lead-zinc-vanadium deposits at Broken Hill, discovered about 50 years ago. In 1929, the Broken Hill Development Co., Ltd., began a new phase of production with an electrolytic zinc extraction plant; in 1931 the production of fused vanadium oxide was initiated; and an extensive drilling and development programme took place between 1935 and 1946 to discover sulphide ore bodies at depth. Following a geophysical survey drilling is now taking place to locate any further deposits.

It is believed that there are extensive mineral deposits yet untapped.

TECHNICAL PUBLICATIONS

(continued from previous page)

Box 1680), Johannesburg. The complete respirator weighs only 2 lb. 14 oz., and employs twin independently replaceable mechanical and chemical filters mounted on the wearer's back. It is said to afford protection against mists, dusts, fumes, organic vapours and acid gases.

* * *

USES of corrosion-resistant alloy steels in the heavy chemical industry and the types of duty to which each class may be applied are examined by F. H. Keating (Imperial Chemical Industries, Ltd.) in the main article of the December issue of the *Nickel Bulletin* (the Mond Nickel Co., Ltd., London).

* * *

THE high standard of reliability required of modern radio apparatus and its many applications necessitate the employment of specialised material for each particular job. Specification RIC/1000/A, recently issued by the Radio Industry Council, is intended as a guide to manufacturers in the choice of materials for radio and electronic equipment. It is divided into two sections which include metallic materials; plastics; elastomers; inorganic insulating materials and insulating, filling and sealing compounds.

* * *

THE large variety of pumps available are indicative of the exacting needs of industries. Viscous liquids such as molasses, crude oils, tar, bitumen, soap and fats have required the production of special pumps such as the Transflo rotary displacement pump, which is described in the current issue of "Wiggin Nickel Alloys" (Henry Wiggin and Co., Ltd., Birmingham). Other articles include the use of Inconel in medical equipment, and the application of nickel to ocean depth sounding equipment.

SOUTH AFRICAN ENTERPRISE

Exploiting Local Raw Materials

FISH body oils are to take the place of imported fats—fast becoming scarce—in the manufacture of soap in South Africa. In 1950 the Union anticipates producing more than 10,000 tons of fish body oil, four-fifths of which is expected to be consumed in the country. This, used in place of imported fat, will not only alleviate the threatened scarcity of soap, but will save the Union about £500,000 in foreign currency next year. The combined South African fishing industry, which operates its own refinery at Simonstown, recently made an offer to all the large soap manufacturers to supply them with this oil at local ruling prices.

Application has been made to the Board of Trade and Industries for the admission under rebate of duty of acetic acid employed in the manufacture of a corrosion-resistant coating for metals produced by a local firm under licence. Acetic acid is dutiable under tariff item No. 212, under which bulk glacial acetic acid, which contains 99 per cent of acetic acid and is the product used by the applicant firm, is dutiable at 32s. per gal. Glacial acetic acid, however, is not at the moment produced in the Union.

Columbit (Pty.), Ltd., 106 Loop Street, Cape Town, plans to establish a factory to make asbestos filter material for the preparation of medicines, the bottling industry, wine merchants, breweries, and for water filtration and oil filtration. Practically all the raw materials required are available in the Union. The technical manager of the Columbit factory at Wiesbaden, Germany, is to go out to the Union to take charge of technical arrangements.

Associated Lead Manufacturers (Pty.), Ltd., Jacobs, Durban, is erecting a new factory for the manufacture of red lead, white lead and litharge for battery manufacturers, etc. Much of the plant in this factory has been made in South Africa. This local company is associated with the U.K. concern, Associated Lead Manufacturers Export Co., Ltd.

Coates Inks, Ltd., has established a local factory at Parow, near Cape Town, in which it is now manufacturing to British specifications printing inks for all processes. These are being made to the same standard of quality as the British inks of the parent company. It is intended to use local materials, as far as possible.

TRADE IN SWISS CHEMICALS

Heightened Market Difficulties

IN its review of Swiss economic developments during 1949, the *Quarterly Bulletin* of the Credit Suisse states that the chemical and pharmaceutical industries, in common with other Swiss industries depending on sales in foreign markets, have been affected by the increased satiation of markets, the growth of foreign competition and the lowered purchasing power of foreign customers.

This important sector of Switzerland's national economy has not been able to maintain exports—which normally amount to one-sixth of total exports—on the 1948 level. Exports of aniline dyes are stated to have declined sharply; in particular sales in Czechoslovakia, but also in the other countries of Eastern and South-Eastern Europe—all important markets before the war—have been reduced.

It has been possible, however, to increase sales to Western Germany and, as a result of compensation transactions, to Egypt and Chile. Exports of auxiliary products for the textile, leather, and paper industries were maintained on the pre-war level despite reduced import quotas.

A welcome increase has been registered in the volume of sales of agricultural chemicals and insecticides, in spite of stiff competition, import and exchange restrictions. Exports of pharmaceuticals goods were slightly improved.

Prices were exposed to strong pressure and, although employment was still satisfactory at the beginning of 1949, staff reductions have since become necessary in many enterprises. Since almost one-half of the export of chemical and pharmaceutical products goes to OEEC countries, it is hoped that the " liberalisation " of European trade will improve sales prospects of Switzerland's chemical industry. It is recognised, however, that the effect of the freedom from quotas has in several countries been negatived to a large extent by increases of customs tariffs.

Pharmaceutical Production in East Germany

Reports from East Germany state that the Microbiological Institute of the nationalised Schott Works in Jena is to be developed into a large producer of pharmaceutical products. Penicillin production is stated already to be sufficient for domestic needs and exports are proposed. Other products are novocaine and morphine.

Indian Chemical Research

Industrialists Urged to Take More Interest

INDIAN chemical manufacturers' dissatisfaction with the Government's handling of import, taxation and marketing policies was expressed at the annual session in Bombay of the Indian Chemical Manufacturers' Association.

The Governor of Bombay (Raja Maharaj Singh), inaugurating the session, called upon the industrialists to take a greater interest in research work and to finance the development of laboratory results into actual commercial production. The Governor emphasised that India's industrial life depended to a large extent on technological advance and discoveries of improved chemical processes.

The Government of India, he said, had planned a chain of regional national chemical laboratories all over the country. These would undertake work that did not ordinarily fall within the scope of industries and their activities would cover a large field, extending by stages from research work of the purely academic type to technical development of processes and equipment.

Mr. S. P. Sen, president of the association, claimed that the liberal import policy followed by the Central Government had largely nullified the expansion projects of the chemical industry. He said that the Government should help the industry in developing new markets for India's trade in chemical products and by encouraging greater production.

Chemical industries in India were facing great difficulties keeping prices at a low level. He urged the Government to revise the basis of the classification of the raw materials and finished products.

As a result of the Government of Bombay's proposal for the large-scale production of power alcohol, to utilise surplus stocks of molasses and to save dollars on petrol imports, the Nasik Distillery, Bombay's liquor manufacturing centre, is to begin producing 3000 gal. of power alcohol a day after April 1, 1950. The sale of alcoholic liquor in the Province ceases on that day.

A plant costing Rs.50,000, ordered from the United Kingdom, is expected in Bombay this month. Almost the whole of the Nasik Distillery will be converted into a power alcohol factory.

The Government of Bombay has also decided to permit private manufacture of power alcohol in the Kolhapur and in two other sugar factories. The Kolhapur factory already has a plant and two more plants are expected soon.

The Government of India has given sanction to the Bombay State Transport Authority to mix denatured spirit with petrol, and experiments conducted by the transport authority have shown that the ratio of the mixture of petrol and power alcohol should be about 60 : 40, or 50 : 50.

The mixture of power alcohol and petrol will initially be used in heavy vehicles.

The annual production of the Nasik factory is expected to exceed 900,000 gal. From January to August, 1949, a total of 2,168,864 gal. of power alcohol was produced in India, compared with 3.52 million in 1948 and 2.2 million in 1947.

India May Refine 25,000 Tons More Copper

THE Government of India has been investigating the possibilities of setting up a copper refinery plant to make India self-sufficient in copper.

Arising out of the Government's decision to set up national industries for manufacturing radio transmitters, heavy electrical equipment and cables, it is estimated that India's copper consumption will rise from a little over 35,000 tons to about 60,000 tons per annum.

The setting up of a plant for refining copper from scrap was considered recently by the Development Committee of the Indian Ministry of Industry and Supply. The technical aspect of the project was investigated in England and the U.S.A. and it was ascertained that conditions in India were favourable.

Investigations in the United Kingdom revealed that a new process of refining copper from scrap at the rate of 25,000 tons per annum could be worked economically in India at an estimated cost of £180,000.

India produces only about 6000 to 7000 tons of refined copper annually from the Bihar mines, which meets barely 20 per cent of her total requirements.

· PERSONAL ·

PROF. ARTHUR PORTER, first occupant of the chair of instrument technology in the Military College of Science, Shrivenham, has left to take up the post of director of research in the Canadian branch of Ferranti, Ltd. During the war the professor worked in various Government research establishments, and in 1946 he joined the National Physical Laboratory where he started a new section on automatic control problems of industry. He will be succeeded by MR. C. HOLT SMITH.

DR. J. W. MCDAVID, chairman of the Nobel Division, I.C.I., Ltd., who has recently returned from a 50,000 mile tour of the U.S.A., has accepted the chairmanship of the new FBI committee in Scotland.

DR. PATRICK D. RITCHIE, formerly head of the department of chemistry, Central Technical College, Birmingham, has taken up his appointment to the chair of chemistry at the Royal Technical College, Glasgow.

SIR JOHN LENNARD-JONES, Plummer professor of theoretical chemistry, Cambridge University, has been nominated a member of the honorary Advisory Scientific Committee of the National Gallery.

MR. ROBERT S. P. WITTUS, a chemist employed by I.C.I., Ltd., at Blackley, and MISS MARY THOMPSON, of Moor Lane, Kersal, a typist in the firm's Manchester office, were married at St. Paul's Church, Kersal, Salford, on December 31.

MR. J. A. HUNT, general manager of the Hymatic Engineering Co., Redditch, Worcs., and chairman of the Birmingham Advisory Committee, Midland Regional Board for Industry, was awarded the M.B.E. in the New Year Honours List for his work in the field of industrial relations.

The title of reader in biochemistry at University College, London, has been conferred on DR. L. MARGARET KERLY.

MR. M. A. COLEFAX and DR. P. H. FRANKEL have been appointed directors of Manchester Oil Refinery, Ltd.

MR. KENNETH G. HOLDEN, chairman of Hardman & Holden, Ltd., Manchester, has been appointed a director of Williams Deacon's Bank, Ltd.

Two new Fellows and seven Associates have been announced by the Textile Institute. Elected to Fellowship are: CHARLES PERCIVAL TATTERSFIELD, assistant manager, Courtaulds, Ltd., Use Development Organisation, Manchester, who has taken out several patents dealing with differential saponification treatment of cellulose ester materials; ALAN BREARLEY, Halifax, technical officer, Wool Industries Research Association. New Associates included ALBERT EDWARD WATTS, Abbey Hey, Manchester, who passed the institute's general textile technology examination at the age of 21, and DARAS NESERWANJI MEHTA, chemist at the Empress Mills, Nagpur (C.P.), India.

The following appointments have been announced by Thomas W. Ward, Ltd., Sheffield: MR. ASHLEY S. WARD, who resigned from the chairmanship, which he had held since 1941, is appointed president. MR. GEORGE WOOD succeeds him as chairman and MR. FRANK R. STAGG becomes deputy chairman. MR. H. W. SECKER and MR. J. WHALTON are joint managing directors.

Obituary

DR. T. LEWIS BAILEY, whose death at Redhill (Surrey) is announced, at the age of 85, was formerly H.M. chief inspector of alkali, etc., works from 1920 until his retirement in 1929. During his tenure of office he devoted much time to the question of effluents from ammonia plants. He also took particular interest in water scrubbing of Gay Lussac tower gases as a means of reducing the acidity of sulphuric acid plant escapes.

The death has occurred suddenly of MR. W. G. FEAKES, cost accountant and personal assistant to the managing director of British Tar Products, Ltd., Sheffield, for nearly 30 years.

Memorial Service

A memorial service will be held at St. Martin-in-the-Fields, London, on Thursday, January 19, at 12 noon, for Mr. Norman Neville, director of the British Chemical Plant Manufacturers' Association, whose death was announced in our last issue.

HOME

Linnean Society

The Linnean Society has amended its bye-laws to limit its membership to 1000, exclusive of honorary, foreign and associate members.

£120,000 Building Plan

Scottish Agricultural Industries, Ltd., has been granted permission to carry out a scheme of alterations and to erect buildings in Saltpans Road, Ayr, to be used for the storage of fertiliser. The estimated cost of the scheme is £120,000.

Exmoor Iron Mines to Re-open

Planning permission has been obtained to re-open old iron mines on Exmoor, near North Molton, Devon. The mines are said to contain micaceous iron oxide ore used in the manufacture of non-corrosive paints.

PT Relief for Water Heaters

The Treasury has made an order the effect of which is to reduce from 100 per cent to 66⅔ per cent the tax on thermal storage water heaters suitable for operation from electric mains; and to exempt from tax instantaneous water heaters not using bottled gas.

Record Exports

Vauxhall Motors in 1949 exported 57,831 vehicles, 4991 more than in 1948. Total value of exports was nearly £16 million. The best customers were Australia, Belgium, Holland, South Africa, New Zealand, India and Switzerland. Shipments are increasing rapidly to Canada and South America.

Sixty-five Ton Distillation Unit

The Motherwell Bridge and Engineering Co., Ltd., has completed a fractionating tower, weighing 65 tons, 96 ft. long, and 13 ft. in diameter, for the new extension to the Grangemouth refinery. Transportation to the East of Scotland began on December 27. The tower will be one of several on this site, all of which are being fabricated in Scotland.

Coal Production

Deep-mined coal production for the first week of the New Year was about 400,000 tons below the average weekly output last year. Comparative figures are: Last week: 3,724,000 tons (deep-mined 3,536,600 tons, opencast 187,400 tons); week ended January 8, 1949: 3,701,000 (deep-mined 3,607,900 tons, opencast 93,100 tons).

Rubber Testing Conference

A one-day conference on the behaviour and testing of rubber under dynamic conditions is to be held in London on March 17 by the Institution of the Rubber Industry.

Health in Foundries

A report on health and safety standards in Britain's foundries, issued by the Amalgamated Union of Foundry Workers, recommends the setting up of a foundry health research committee, financed by State funds.

Gifts to Leeds University

The recently formed rayon technology department of Leeds University has received an anonymous gift of £40,000. The International Wool Secretariat has made a grant of £2000 to the department of biomolecular structure.

Steel Records Continue

With an ingot output of 491,760 tons during 1949, John Summers & Sons, Ltd. has broken all production records of its steelworks at Shotton. The slab and strip mills and finishing departments have surpassed all previous totals to make possible deliveries of steel sheets and plates totalling 432,117 tons.

Carbonation for Water Treatment

The town council of Ince, near Wigan, is to spend £1000 on a carbonisation plant to neutralise the lime deposits on the town's mains and service pipes. The water, normally very hard, is drawn from artesian wells at Golborne, whose council has asked the Ministry of Health to hold an inquiry into its water supply.

Cellulose Caused Fire

The fire which recently destroyed the factory and offices of E. Greaves & Son (Case Makers), Ltd., Sheffield, was stated by the Sheffield Fire Brigade to have been caused by a spark from a small electric booster for spraying cellulose having ignited vapours given off by the nitrocellulose lacquer.

Laundry Exhibition

The first exhibition for 12 years of the Laundry, Dry Cleaning and Allied Trades will be held at Olympia, London, from September 28 to October 7. All branches of the trade will be fully represented, including starches, soaps, and chemical requisites. Plans are in hand for holding an International Laundry Congress about the same time.

OVERSEAS

Penicillin Millionaire

A penicillin manufacturer is reported to be one of the 23 millionaires in Japan, according to the latest tax returns.

German Steel Below Target

Steel production in Western Germany rose by about 50 per cent last year with a total production 9.026 million tons, but failed to reach the 1949 target—9.6 million tons. Total output in 1948 was 5.92 million tons.

Indonesian Drugs

Claimed to be the first Australian manufacturing enterprise to operate in the new Republic of the United States of Indonesia, Nicholas Pty., Ltd., of Melbourne, Victoria, established a drug factory at Batavia last month. The plant, employing 90 Indonesians, is expected to be in full production within a year.

Australian Steel Prospect

Two U.S. consulting engineers of H. A. Brassert and Company have reported in New York that a small steel plant could be ready to operate in southwest Western Australia in two years, using the Collie coalfields and high-grade ore from Koolan Island. The engineers have been in Western Australia at the invitation of the Western Australian Government.

Canadian Industrial Gases

Manufacturing plants in Canada engaged chiefly in the manufacture of industrial gases in 1948 had a production value of $11.314 million, compared with $9.607 million in the preceding year (+ 17.8 per cent). The chief products were oxygen, acetylene and carbon dioxide. There were 45 factories in operation, 18 in Ontario, 10 in Quebec, four in Alberta, and four in British Columbia.

Rise of Australian Plastics

The rapidly developing plastics industry in Australia estimates that consumption per head of the population in 1949 was 2 lb. Imports during the year (unfinished articles) were valued at £9 million. Reports indicate that the most recent trend is towards large mouldings. A 5000-ton compression press was recently installed in the plant of a Melbourne company. Two 22 oz. injection machines are to raise the already large capacity of a Sydney injection moulding factory.

Swedish Molybdenum

An occurrence of molybdenum ore stated to have an Mb-content of up to 10 per cent is reported to have been discovered in the Björstorpa mine in Snavlunda, Sweden.

Europe's Coal Needs

Reduction from 5 million tons in the first quarter of 1949, of the apparent hard coal deficit for Europe, to 1.6 million tons is shown by a recent assessment by the Economic Commission for Europe.

Oil Discovery in Czechoslovakia

Oil has been discovered near Malscky, Slovakia, according to the official news agency. Russian oil experts, who will control the development and disposal of the oil, are said to consider these occurrencies as an extension of the important Austrian oil fields near Zistersdorf.

Decline in Peat Industry

Demand in Finland for peat production which was considerably increased during the war when imported oil derivatives were not available, has declined rapidly and it is reported that 23 enterprises had to go out of business. The chief user of peat has been the Finnish State Railways which have used 80,000 tons per annum.

Phosphate Fertiliser Without H_2SO_4

The Chemical Works, Heinrichshall, Thuringia, East Germany, is reported to be manufacturing phosphate fertiliser without the use of sulphuric acid. Reports in the area state that 50 tons of the product are being made daily. A large works at Rüdersdorf near Berlin, with an annual output of 150,000 tons, is planned to be completed in May. The new process is stated to be capable of saving 56,000 tons of sulphuric acid annually.

Australian Lead Oxides

Production of white lead, which has been scarce in Australia, is being expanded by several new enterprises. A new factory at Cabarita, New South Wales, opened in May last by British-Australian Lead Manufactures Pty., Ltd., has been producing with the Librex process, and the company is replacing an established factory at Port Adelaide, South Australia with a new plant. New factories are also to be established in Queensland, and in Wellington, New Zealand.

Next Week's Events

MONDAY, JANUARY 16

The Royal Institute of Chemistry

Leeds: University, 6 p.m. Prof. W. Q. Kennedy: "Geochemistry."

Institution of Works Managers

Sheffield: Royal Victoria Station Hotel, 7 p.m. A. H. Huckle: "Running a Small Factory."

Electrodepositors' Technical Society

London: Northampton Polytechnic, St. John Street, Clerkenwell, E.C.1. H. Silman and B. E. Love: "Investigations on Protective Black Oxide Coatings on Steel."

TUESDAY, JANUARY 17

Society of Chemical Industry

London: 26 Portland Place, W.1, 6.30 p.m. (Textile Institute and Society of Dyers and Colourists invited). Dr. T. H. Morton (Textile Research Laboratories, Courtaulds, Ltd., Bocking, Essex); "Textile Applications of Synthetic Resins."

Chemical Engineering Group (SCI)

London: Burlington House, Piccadilly, W.1, 5.30 p.m. W. T. Farmer: "Flour Milling."

Institute of Physics

London: 47 Belgrave Square, S.W.1, 5.30 p.m. (Electronics Group.) Dr. D. K. C. Macdonald (Clarendon Laboratory, Oxford): "Fluctuations Noise and Recent Developments."

Hull Chemical and Engineering Society

Hull: Church Institute, Albion Street, 7.30 p.m. W. F. Potter: Presidential address.

Institute of Petroleum

Manchester: Engineers' Club, Albert Square, 6.30 p.m. Annual general meeting. Col. S. J. M. Auld.

Institute of Fuel

London: Institution of Mechanical Engineers, Storey's Gate, St. James's Park, S.W.1, 5.30 p.m. F. B. Korthauser and G. C. H. Sharpe: "Downjet Coke Firing for Small Steam Generators"; F. F. Ross and G. C. H. Sharpe: "The Burning of Coke by the Downjet Method"; G. C. H. Sharpe: "The Coke-fired Downjet Furnace in Industry."

Ministry of Fuel and Power

Buckingham: Stowe School. Three-day Oil Firing Course. Instruction in most efficient working of a liquid fuel installation and means of obtaining highest thermal results.

WEDNESDAY, JANUARY 18

Society of Chemical Industry

London: 1 Wimpole Street, W.1, 6.30 p.m. (with RIC). A. K. Soper: "The Physical Chemistry of the Gelatin Water System."

Institute of Physics

London: 47 Belgrave Square, S.W.1, 5.30 p.m. E. W. Golding (British Electrical and Allied Industries Research Association): "Windmills as Electrical Power Generators."

Incorporated Plant Engineers

London: Royal Society of Arts, John Adam Street, Adelphi, W.C.2, 7 p.m. H. O. Parrack: "Operation and Maintenance of Contracting Plant."

Bristol: Grand Hotel, 7.15 p.m. Commander G. C. T. Turner: "Routine Inspection and Maintenance of Industrial Refrigeration Plant."

Institution of Structural Engineers

Manchester: Reynolds Hall, College of Technology, 7 p.m. (Graduates' and Students' section): "Welded Frames."

Manchester Metallurgical Society

Manchester: Engineers' Club, Albert Square, 6.30 p.m. J. Ward (Technical College, Huddersfield): "Photo Elasticity."

Royal Statistical Society

Newcastle-on-Tyne: Newcastle Chemical Industries Club, 18 Lovain Place, 6.30 p.m. (North-Eastern Group). D. G. Beech: "Graphs and Correlation."

THURSDAY, JANUARY 19

The Chemical Society

London: Royal Institution. Albemarle Street, W.1, 7.15 p.m. Tilden lecture. Prof. M. G. Evans: "Studies on Electron-transfer Reactions."

Hull: University College, 6 p.m. (with Hull University College Scientific Society). Prof. E. E. Turner: "Modern Trends in Stereochemistry."

Manchester: University. 6.30 p.m. (with RIC and SCI). Prof. C. A. Coulson: "Localised and Non-localised Bonds."

Sir John Cass Technical Institute

London: Jewry Street, Aldgate, E.C.3, 6 p.m. First of series of ten lecture-demonstrations. David W. Wilson and F. Holmes: "Microchemical Analysis."

Incorporated Plant Engineers

Liverpool: Radiant House, Bold Street, 7 p.m. T. M. Beeston: "The Plant Engineer's Guide to Steam Costing."

Electrodepositors' Technical Society

Birmingham: Edgbaston, Botanical Gardens, 6.30 p.m. (Midlands Centre). Annual dinner and dance.

Institute of Physics

Birmingham: University, Edmund

Street, 5 p.m. D. A. Wright: "Thermionic Emission."

FRIDAY, JANUARY 20

The Chemical Society

Birmingham: University, Edgbaston, 4.30 p.m. (with Birmingham University Chemical Society). Dr. J. K. N. Jones: "The Separation and Determination of the Sugars and their Derivatives."

Northern Ireland: Belfast, Royal Academical Institution, 7.30 p.m. (with RIC and SCI). J. McG. Jackson: "Chemical Education."

Society of Chemical Industry

London: Burlington House, Piccadilly, W.1, 6.30 p.m. (Food and Fine Chemicals Groups). Prof. A. C. Frazer: "Fine Chemicals and the Food Industry."

Oil and Colour Chemists' Association

Birmingham: Chamber of Commerce, New Street, 6.30 p.m. J. A. Waddams: "Mechanism of Certain Photographic Effects of Drying Oil Films."

Institute of Physics

Manchester: University, 7 p.m. J. A. Hall (National Physical Laboratory): "Temperature Measurement."

SATURDAY, JANUARY 21

Institution of Chemical Engineers

Liverpool: (North-Western branch with SCI). A. A. Martin: "Modern Boiler Plant Practice."

Exhibition and Fairs in 1950

United Kingdom.

Manchester: Building Trades Exhibition, City Hall, Deansgate. April 18-29.

London: International Stamp Exhibition, Grosvenor House, Park Lane, W.1. May 6-13.

London and Birmingham. British Industries Fair, May 8-19.

London: Olympia. National Mechanical Handling Exhibition. June 6-17.

London: Earls Court. Industrial Finishes Exhibition. August 30-September 7.

London: Olympia. Laundry Drycleaning and Allied Trades Exhibition. September 28-October 7.

London: Olympia. Brewers' Exhibition, October 2-6.

London: Olympia. Public Works and Municipal Services—Congress and Exhibition.

Overseas.

Copenhagen: Danish Industrial Exhibition. March 17-26.

Utrecht: Royal Netherlands Industries Fair. March 21-30.

Basle: Swiss Industries Fair. April 15-25.

Lyons: International Fair. April 15-24.

Brussels: International Fair. April 29-May 14.

Liege: International Fair. April 29-May 14.

Poznan: International Trade Fair. April 29-May 14.

Hanover: German Industries (Technical) Fair. May 3-14.

Paris: International Trade Fair. May 13-29.

Prague: International Fair. May 14-28.

Toronto: Canadian International Trade Fair. May 29-June 9.

Nairobi: Industrial Equipment and Engineering Fair. June 9-24.

Toronto: 33rd Canadian Chemical Conference and Exhibition. June 19-22.

Chicago: International Trade Fair. August 7-19.

Izmir: International Fair. August 20-September 20.

Ghent: International Fair. September 9-24.

Frankfurt: Autumn Fair. September 17-22.

CHEMICAL LECTURES

Ample Programme for 1950

VARIOUS methods of chemical analysis will be covered in the series of lectures organised by the department of chemistry of the Sir John Cass Technical Institute, Jewry Street, Aldgate, E.C.3. The series forms part of an unusually full programme of information on scientific and industrial topics being offered by several organisations in the next few months.

Spectrochemical analysis is the subject of the first course of 12 lectures by A. S. Nickelson and A. R. Philpotts to be held on Friday evenings, beginning January 13. An introductory lecture will be given by Dr. S. Judd Lewis, and the course will be followed by ten periods of laboratory work (for a limited number of students) on Friday evenings, beginning on April 21.

Microchemical analysis will be dealt with in ten lecture-demonstrations by David W. Wilson and F. Holmes on Thursday evenings beginning on Jan. 19.

Radiochemical methods of analysis will be explained in a course of nine lectures to be given on Tuesday evenings beginning January 17.

At the Polytechnic, Regent Street, London, W.1, the department of chemistry has arranged a course of four lectures on "Advances in the Science and Technology of Synthetic Fibres." The series begins on February 14 and will be held on Tuesday evenings. The lecturer will be Claude Diamond who will cover the scientific and technological aspects.

The Stock and Chemical Markets

BUSINESS in stock markets was on a small scale, reflecting the caution enjoined by rumours of an early General Election. Although selling was only moderate, British Funds fell back sharply, 3½ per cent War Loan to 91¼, Treasury 2½ per cent to 68¼, while 3 per cent Transport was down to 88 and 3 per cent Gas stock 87.

Small declines prevail in the industrial sections at the time of writing, although a rally in industrial shares was considered probable on hopes of a change of Government. Buying interest was meanwhile centred mainly on gold mining, rubber and other shares of overseas companies.

With few exceptions, shares of chemical and kindred companies have not shown movements exceeding more than a few pence, but small declines predominated. Imperial Chemical eased to 42s. 1½d. with the general trend, although there is widespread confidence that the dividend will be maintained at 10 per cent. Monsanto have been firm at 51s. 3d., with Albright & Wilson at 29s. 6d., Boake Roberts 25s. 6d., Brotherton 10s. shares 19s. 3d., F. W. Berk 14s. 3d., Pest Control 8s. 7½d., and Bowman Chemical 5s. 6d., while elsewhere, Laporte Chemicals 5s. ordinary changed hands around 9s. 4½d. The 4s. units of the Distillers Co. remained fairly active around 17s., but following their recent advance, United Molasses came back to 40s. Turner & Newall were active, but at 73s. 9d. have not held all the improvement which followed publication of the full results and the chairman's statement that in future it is not intended to continue restriction of dividends, unless limitation were enforced by law.

Lever & Unilever have been steady at 43s. 9d., but elsewhere, British Aluminium eased to 40s. 6d., and Dunlop Rubber to 61s. 9d. British Xylonite have also been easier at 58s. 9d., British Industrial Plastics 2s. shares lower at 4s. 4½d., and De La Rue 22s. 9d. Glaxo Laboratories 10s. units remained active in their "ex" bonus form, but lost a few pence at 45s. 9d. Boots Drug at 50s. failed to hold best levels, British Drug Houses 5s. ordinary were 6s. 6d., and British Glues & Chemicals 4s. ordinary eased to 18s. 9d., but Blythe Colour strengthened to 27s. 6d.

There was again a firmer trend in iron and steels on the view that nationalisation may never take place. Firth Brown moved up 2s. 6d. to 71s. 3d., Dorman Long were 32s., United Steel 27s. 9d., Stewarts & Lloyds 53s. 4½d., while in other directions, Babcock & Wilcox rallied slightly to 60s. 6d., Guest Keen were 41s. 9d., Staveley 81s., and Powell Duffryn have been at 27s. Borax Consolidated deferred (57s. 3d.) remained firm on expectation of good results because of the company's dollar earning business and interests in the U.S., although it was realised that dividend limitation would prevent shareholders from having a bigger distribution.

Oil shares lost further ground, partly on fears of competition and price-cutting between American and British companies if there is no compromise solution on Britain's decision to reduce oil imports from the dollar areas. A sharp fall in Burmah Oil to 50s. 7½d. followed the removal of the Government guarantee against loss on reconstruction work in Burma. Nevertheless, it is believed in the market that Burmah Oil will be able to maintain its dividend, because of the large investment income from its big holdings in Shell and Anglo-Iranian. At the time of writing, Shell had eased to 63s. 1½d., and Anglo-Iranian to £6⅜.

Market Reports

THERE has been a steady movement in all sections of the industrial chemicals market, with consumers' delivery specifications once again covering good volumes. The flow of export inquiry remains steady, though actual bookings are becoming more and more a question of competitive prices. An active demand continues for most of the soda products and, apart from an advance of 10s. per ton for sodium sulphide and firmer quotations for percarbonate of soda, no important price changes have been notified in this section. The potash chemicals remain in steady call at firm rates. Other items attracting a fair amount of attention include formaldehyde, hydrogen peroxide and bleaching powder. Increased prices have been reported for precipitated barium carbonate and precipitated barium sulphate. The former has been advanced by 30s. per ton and is now quoted at £27 5s. per ton while the latter is £3 per ton dearer at £29 15s. per ton. Due to an increase in the price of zinc all grades of zinc oxide have been advanced by 35s. per ton. Rather quiet conditions persist generally for coal tar products. There is

(*continued overleaf*)

LAW AND COMPANY NEWS

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

BRITISH MINERAL CORPORATION, LTD., London, S.W. (M., 14/1/50.) December 5, debenture, to Barclays Bank, Ltd., securing all moneys due or to become due to the Bank; general charge. *Nil. November 30, 1948.

REYNOLDS SCIENTIFIC GLASS WORKS, LTD., London, S.W. (M., 14/1/50.) December 1, £2000 (not ex.) charge, to Lloyds Bank, Ltd.; charged on 9 The Broadway, Wimbledon. *£375. April 20, 1949.

Receivership

MONO-PLASTIC CHEMICALS, LTD., 19 Grosvenor Place, S.W.1. (R., 14/1/50.) Mr. Albert A. Henley, of 19/20 Grosvenor Place, S.W.1, ceased to act as receiver and manager on December 14, 1949.

Company News

Change of Name

The company hitherto known as Electronic Transmission Equipment, Ltd., has been re-named Mullard Equipment, Ltd.

Scientific Periodicals

UNDER an agreement between the Academy of Sciences, at Berlin and at Göttingen, and the German Chemical Society, *Chemisches Zeutralblatt* has resumed publication this year. The periodical, which celebrates its 120th anniversary in December, is distributed by Akademie - Verlag GmbH, Schiffbauerdamen 19, Berlin, NW7.

The Society of Chemical Industry starts publication this month of the *Journal of the Science of Food and Agriculture*, to contain papers on original research in food and agriculture that will no longer appear in the *Journal of the Society of Chemical Industry*. It will be issued monthly and review recent work in some branch of food or agriculture.

Physics in Sweden

THE Institute for Nuclear Chemistry in Upsala was solemnly opened on December 8 by Crown Prince Gustaf Adolf, who cordially commended the Nobel Laureate, Prof. T. Sverberg, for his outstanding contributions to science during more than four decades at Upsala University.

The large subterranean cyclotron, which forms part of the institute, is nearing completion. It is being built by the Swedish firm L-K-B-Products in co-operation with the ASEA works and Domnarvet steel works and leading Swedish scientists. Another cyclotron belonging to the Physics Institute of the Royal Academy of Science, just outside Stockholm, is also in its final stages of construction.

MARKET REPORTS

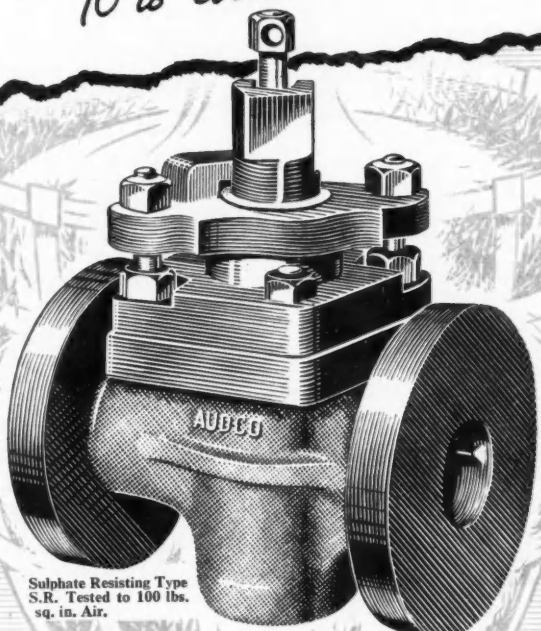
(*continued from previous page*)

demand for creosote oil and the pyridines. Cresylic acid continues to attract very little interest.

MANCHESTER.—Business on the Manchester chemical market during the past week has been fairly active and is now more or less back to normal. Home-trade users are calling for steady deliveries of soda and potash compounds and a wide range of other heavy chemicals. A reasonably satisfactory weight of new business has been placed by home consumers, as well as by shippings, the latter being mainly for export to Empire outlets. Prices generally remain firm and the sulphides of soda and one or two other chemicals are dearer. The market for fertilisers and for tar products has also been busier.

GLASGOW.—A number of Scottish works have been closed the whole week for the New Year Holidays and all have been closed for part of the week. The turnover at this time of the year is very small. The export market has been a little more active, particularly with heavy inquiries for trisodium phosphate, for which the earliest shipment is now 4-5 months, as a result of heavy bookings.

Specify
Type S.R. for H_2SO_4 above
70% concentration



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STABLE GAS CONTAINER

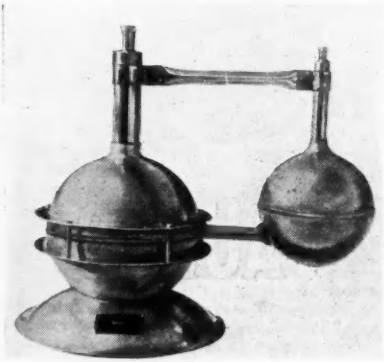
Low Temperature Storage Device

A STEP towards solving the problem of storing under stable conditions liquid hydrogen and liquid helium is the production in the U.S.A. of a container for storage and transport, which is expected to encourage wider use of the gases.

The Hofman Liquid Hydrogen Container, for which United States Patent No. 2,453,946 has been granted (Hofman Laboratories, Inc.), employs three concentric copper spheres. The inner and outer spheres form a conventional vacuum flask, with facing interior surfaces polished to a mirror-like finish. Between them is placed a third sphere, highly polished on both sides, which acts as a radiation shield. This shield is attached by a unique connection to the inner sphere of a smaller side flask of liquid nitrogen.

Liquid hydrogen boils at —254° C., so that it rapidly returns to the gaseous state even in a conventional vacuum flask. The new container greatly limits this action by providing a cold barrier in addition to vacuum insulation and reflecting surfaces. The radiation shield of the main flask is cooled by conduction to the temperature of the liquid nitrogen in the side flask. Evaporation losses of liquid hydrogen (or helium) in storage and handling are said to be reduced to a negligible amount. The principle has been exhaustively tested, with good results.

The containers are being made in 10, 25, and 50 litre capacities with side flasks holding 5, 15, and 25 litres.



The flask and its liquid nitrogen temperature regulator

DIEPOXYHEXANE

New Derivative of Diallyl

DIALLYL can readily be made by the action of a metal on allyl chloride.

$$CH_2:CHCH_2Cl + Mg + Cl\,CH_2\,CH:CH_2 \rightarrow CH_2:CHCH_2CH_2CH:CH_2 + MgCl_2$$

Diallyl or 1:5 hexadien appears to offer considerable possibilities as an intermediate in syntheses, particularly of long chain compounds. But an unusual reaction of one of its derivatives diepoxyhexane has lately been reported; in this case instead of forming long chain compounds it forms a closed ring.

According to D. J. C. Wood and L. F. Wiggins (*Nature*, *164*, 402, 1949), diallyl can be converted to 1:2-5:6-diepoxyhexane by treatment with perbenzoic acid; the yield is 80 per cent.

$$CH_2:CHCH_2CH_2CH:CH_2 \rightarrow CH_2CHCH_2CH_2CHCH_2$$

Diallyl — Diepoxyhexane

The epoxide rings are easily hydrolysed, *e.g.*, by boiling with water. It was expected that the product which would be formed would be 1,2,5,6-tetrahydroxyhexane.

In practice this reaction did not take place. Instead, only one molecule of water was taken up, ring closure occurred and 2:5-*bis*hydroxymethyl tetrahydrofuran was formed in 65 per cent yield.

$$CH_2CHCH_2CH_2\ CH\ \ CH_2 + HO_2 \rightarrow$$

$$HO\,CH_2\text{-}CH\quad CH\text{-}CH_2OH$$

Diepoxyhexane — 2:5-*bis*hydroxymethyl tetrahydrofuran

This substance formed a crystalline (m.p. 114-118° C.) *p*-toluene sulphonate

$$CH_3C_6H_4SO_2OCH_2CH \qquad CH\,CH_2OSO_2C_6H_4CH_3$$

and when this was treated with methyl alcoholic ammonia an imine was formed which had the constitution

$$CH_2 - CH_2$$
$$CH \quad CH$$
$$CH_2 \quad O \quad CH_2$$
$$NH$$

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Patent Processes in the Chemical Industry

The following information is prepared from the Official Patents Journal. Printed copies of specifications accepted will be obtainable, as soon as printing arrangements permit, from the Patents Office, Southampton Buildings, London, W.C.2, at 2s. each. Higher priced photostat copies are generally available.

Complete Specifications Accepted

Splicing of organic mono-filaments.—Firestone Tire & Rubber Co. June 20 1946. 633,082.

Process for the production of dibasic carboxylic acids.—E. I. Du Pont de Nemours & Co. Nov. 30 1945. 633,354.

Resinous compositions comprising amino-formaldehyde condensation products.—British Industrial Plastics, Ltd. Jan. 12 1946. 633,356.

Separation of gaseous and gas-and-vapour mixtures.—American Magnesium Metals Corporation. May 18 1940. 633,137.

Production of side-chain chlorinated methyl naphthalenes.—Petrocarbon, Ltd., H. S. Boyd-Barrett, J. R. Holker, and H. M. E. Steiner. Feb. 24 1947. 633,097.

Process for preparing complex organic compounds of antimony.—E. A. H. Friedheim. April 9 1946. 633,370.

Compositions of matter comprising anacardic phenols, aldehydes and aniline, and their inter-reaction products.—British Resin Products, Ltd. May 1 1946. 633,143.

Process and apparatus for dispersing an aeriform body in a liquid body.—L. E. Jones. (Shawinigan Chemicals, Ltd.). May 16 1947. 633,378.

Processes and apparatus for the treatment of hafnium, zirconium, titanium, thorium and their alloys in the molten state.—W. J. Kroll. April 7 1947. 633,117.

Methods of preparing 2-ethyldibenzofuran.—British Thomson-Houston Co., Ltd. June 13 1946. 633,151.

Cellulose ether compositions.—British Celanese, Ltd. June 14 1946. 633,152.

Hydrogenation of cashew nut shell liquid.—Harvel Corporation. March 21 1945. 633,165.

Manufacture of copperable polyazo dyestuffs.—J. R. Geigy A.G. Aug. 2 1946. 633,166.

Methods of recovering silver from residues containing the same.—British Thomson-Houston Co., Ltd. Aug. 7 1946. 633,119.

Silencing of gaseous currents.—Silto Soc. Anon. Nov. 21 1946. 633,120.

Antibiotic preparations and process for obtaining the same.—Parke Davis & Co. Sept. 3 1946. 633,175.

Production of aromatic aldehydes.—E. I. Du Pont de Nemours & Co. Aug. 24 1946. 633,176.

Vitreous enamels and compositions for use in the preparation of the same.—C. E. Every. Aug. 27 1947. 633,178.

Production of aldehydes.—I.C.I., Ltd., A. W. C. Taylor, and G. Turner. Oct. 13 1947. 633,184.

Precipitation and filtration of gold and silver from cyanide solution.—Huntington, Heberlein & Co., Ltd. (E. N. H. Molloy). Oct. 22 1947. 633,203.

Process for the manufacture of copper-containing azo dyestuffs.—Sandoz, Ltd. Dec. 13 1946. 633,206.

Process for the manufacture of vinyl chloride.—N.V. De Bataafsche Petroleum Maatschappij. Dec. 17 1946. 633,211.

Azo pigments.—I.C.I., Ltd., J. Glassman, and D. T. Sarfas. Dec. 10 1947. 633,215.

Process for the manufacture of 2-amino-6-hydroxy-8-(hydroxymethyl)-pteridine.—Roche Products, Ltd. Feb. 3 1947. 633,227.

Production of thiophene.—Socony-Vacuum Oil Co., Inc. Sept. 28 1944. 633,239.

Production of alkyl derivatives of thiophene.—Socony-Vacuum Oil Co., Inc. Sept. 29 1944. 633,240.

Process for the manufacture of 5, 6, 7, 8-tetrahydroisoquinoline. — Roche Products, Ltd. Feb. 12 1947. 633,266.

Removal of sulphur dioxide from gases.—Simon-Carves, Ltd., Mayor, Aldermen and Councillors of the Metropolitan Borough of Fulham, W. C. Parker, and E. W. F. Gillham. Aug. 26 1946. 633,627.

Purification of sugar solutions.—A. H. Stevens. (American Cyanamid Co.). Sept. 19 1946. 633,552.

Process of neutralising acid, phosphate-containing solutions of calcium nitrate.—Directie Van De Staatsmijnen in Limburg. June 12 1945. 633,699.

Strong, homogeneous, coherent coatings and self-sustaining films and method of forming same.—B. F. Goodrich Co. Nov. 30 1943. 633,630.

Recovery of acetone, ethyl alcohol and butanol from their acqueous solution by distillation.—Commercial Solvents (Great Britain), Ltd., H. N. Darlington, and H. Holdsworth. Nov. 25 1946. 633,706.

Production of compounds containing the isoprene grouping.—L. E. Jones. (Distillation Products, Inc.). Dec. 24 1946. 633,711.

Special Announcement

J. M. STEEL & CO. LTD. *have pleasure in informing their customers in the Midlands that they have opened a Branch Office at :—*

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Telephone Nos. : Deansgate 6077/9 **Telegrams : Heavychems Manchester**

Manufacture of silica gel-containing catalysts.—C. Arnold. (Standard Oil Development Co.). Jan. 28 1947. 633,635.

Method and apparatus for the production of gas suitable for chemical synthesis.—Soc. Anon. Forni Ed Impianti Industriali Ingg. De Bartolomeis. June 10 1943. 633,718.

Processes for preparing alkyl aryl ketones and the alkyl aryl resulting therefrom.—Monsanto Chemical Co. June 26 1946. 633,724.

Process for producing para-vinylbenzyl acetate, paravinylbenzyl alcohol and polymers and copolymers thereof.—Monsanto Chemical Co. June 22 1946. 633,727.

Dealkylation of polyalkyl alicyclic ketones and alcohols.—Standard Oil Development Co. June 27 1946. 633,434.

Process for producing para-acetylbenzyl acetate para-(alpha-hydroxethyl) benzyl acetate and para-(alpha-acetoxyethyl) benzyl acetate.—Monsanto Chemical Co. June 22 1946. 633,435.

Demulsifying compositions.—American Cyanamid Co. May 8 1946. 633,644.

Processes of preparing isopropenyldiphenyl and the products resulting therefrom.—Monsanto Chemical Co. Jan. 20 1945. 633,646.

Methods of preparing resinous condensation products and the compositions resulting therefrom.—Monsanto Chemical Co. June 12 1946. 633,438.

Methods of drying gelatine layers.—N.V. Philips' Gloeilampenfabrieken. June 1 1946. 633,731.

Production of organohalosilanes.—Dow Corning Corporation. June 6 1946. 633,732.

Production of oxazolone derivatives.—Ilford, Ltd., J. D. Kendall, and G. F. Duffin. June 11 1947. 633,736.

Protection of magnesium and magnesium base alloys against corrosion.—Magnesium Elektron, Ltd. June 13 1947. 633,653.

Preparation of 2-amino-4-hydroxy-6-methyl pyrimidio (4, 5-b) pyrazines.—American Cyanamid Co. July 27 1946. 633,656.

Compositions comprising plastic polymerised chloroprene.—B.B. Chemical Co., Ltd. Jan. 31 1940. 633,745.

Process for the manufacture of N-(p-arsenosobenzyl)-glycineamide and salts thereof.—Roche Products, Ltd. Nov. 27 1946. 633,459.

Electrodeposition of zinc and anodes for use therein.—Hudson Bay Mining & Smelting Co., Ltd. Aug. 7 1941. 633,468.

Manufacture of sulphur.—Anchor Chemical Co., Ltd., R. Darlington, V. Oakes, and K. C. Roberts. Nov. 1 1947. 633,469.

Production of organic fluorine compounds.—I.C.I., Ltd., H. R. Leech, and R. Le G. Burnett. Nov. 17 1947. 633,678.

Catalysts.—I.C.I., Ltd., and P. W. Reynolds. Dec. 5 1947. 633,531.

Process for synthesising vinyl esters of carboxylic acids.—Soc. Belge De l'Azote et Des Produits Chimiques Du Marly. March 21 1944. 633,681.

Preparation of sodium thiosulphate for testing water.—A. H. Cox Co., Ltd., W. Killner, and D. C. Ford. Jan. 14, 1948. 633,533.

Apparatus for separating and removing liquid and other impurities from gaseous fluid under pressure.—Superheater Co., Ltd. (Superheater Co.). Jan. 23 1948. 633,607.

Apparatus for electrolysis.—Laporte Chemicals, Ltd., C. O. Bishop, and H. L. Hulland. Feb. 17 1948. 633,541.

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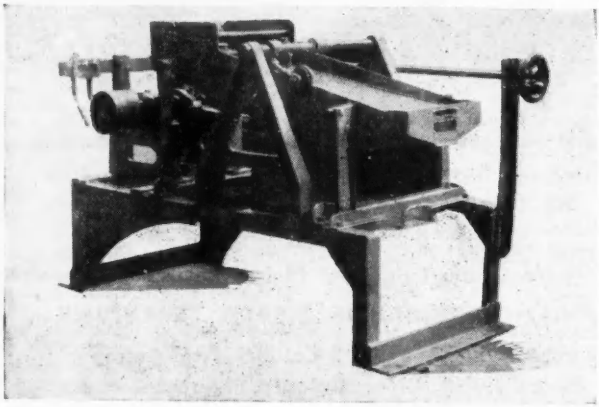

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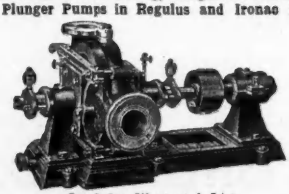

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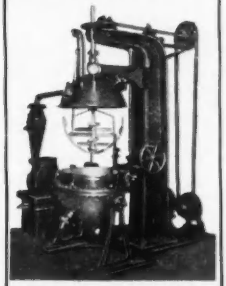

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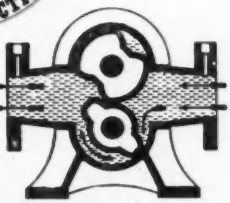

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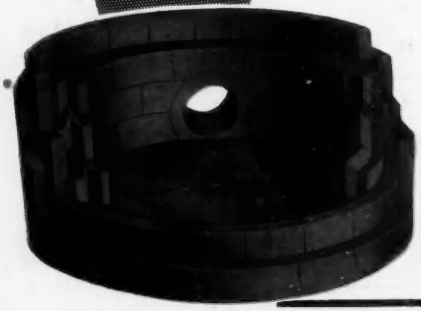

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